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OMEGA SIGNAL COVERAGE PREDICTION DIAGRAMS FOR 10.2 KHZ. VOLUME --ETC(U)

OCT 80 R R GUPTA, S F DONNELLY, P M CREAMER

DOT-CG-951480-A

UNCLASSIFIED TASC-TR-3077-2-VOL-3

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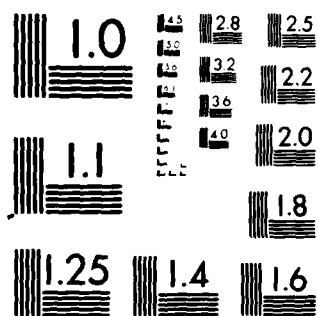
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LEVEL III

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**OMEGA SIGNAL COVERAGE
PREDICTION DIAGRAMS FOR 10.2 kHz.
VOLUME III. COMPOSITE DIAGRAMS.**

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October 1980

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FINAL REPORT

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Prepared for

U.S. DEPARTMENT OF TRANSPORTATION
UNITED STATES COAST GUARD
Omega Navigation System Operations Detail
Washington, D.C. 20593

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Final Report Sept. 1979 - Oct. 1980		
16. Abstract		
<p>Individual Omega station and composite (Omega Navigation System) 10.2 kHz signal coverage prediction diagrams have been developed for eight times. The diagrams show the global accessibility of "usable" 10.2 kHz signals at eight fixed diurnal/seasonal times for two usable signal access criteria. Criterion I requires: signal-to-noise ratio (SNR) ≥ -20 dB (in a 100 Hz noise bandwidth) $> \Delta\phi$ and $\Delta\phi \leq 20$ centicycles (cec), where $\Delta\phi$ is the modal interference-induced phase deviation in the signal phase relative to the reference signal phase. Criterion II differs from Criterion I in that the SNR ≥ -30 dB. Volume I presents the diagram development methodology and contains individual station nighttime modal interference diagrams. Each modal interference diagram identifies regions throughout the world where $\Delta\phi \leq 20$ cec for nighttime propagation conditions.</p> <p>Volume II presents 64 individual Omega station diagrams (Mercator projection): eight selected coverage times for each of eight stations. Each diagram displays the SNR and $\Delta\phi$ contours for a designated signal access criterion and coverage time.</p>		
17. Key Words	18. Distribution Statement	
OMEGA Very Low Frequency Propagation Omega Signal Coverage Diagram Omega Modal Interference Diagram	Document is available to the U.S. public through the National Technical Information Service Springfield, Virginia 22161	
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UNCLASSIFIED

SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

16. ABSTRACT (Continued)

Volume III contains 48 composite coverage diagrams which embody the eight coverage times, two signal access criteria, and three different projections (North and South pole centered Azimuthal Equal Distance, and Mercator). Each diagram displays the global accessibility of usable signals from the system for a designated signal access criterion and coverage time.

Volume IV tabulates the bearing angles of great circles to each Omega station. These angles are computed at latitude/longitude grid points having a uniform spacing of four degrees.

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PREFACE

This volume contains 48 composite (full system) 10.2 kHz signal coverage prediction diagrams: eight selected coverage times (0600 and 1800 GMT in February, May, August and November) for each of two usable signal access criteria and three cartographic projections. The two criteria are based on threshold values of signal-to-noise ratio (SNR) and modal interference-induced deviations in the signal phase ($\Delta\phi$). Both criteria require $\Delta\phi < 20$ cec (centicycles). Criteria I and II require $\text{SNR} \geq -20$ dB (decibels) and $\text{SNR} \geq -30$ dB, respectively.

The composite diagrams display the global accessibility of usable 10.2 kHz signals from the full system (all Omega stations) at a selected time based on one of the two signal access criteria. The composite coverage at each selected time is displayed in a Mercator projection and in two Azimuthal Equal Distance (AED) projections, centered at the North and South Pole. In each diagram, the combination of signals that can be accessed in a region is indicated by the set of letters within the contours enclosing the region. For example, in the composite diagram shown on page 1, the expected coverage in Iceland is from stations A, B, D, F and H. Some regions display a number indicating the number of signals that can be received in that region. These stations, however, can be readily determined as each coverage contour is labeled with a station designator and an arrow in the direction of the accessibility of the usable signal from the labeled station. For example, the region around the Norway station in the diagram shown on page 1 is labeled with a 6. Coverage in this region is from stations B, C, D, E, F and H. The coverage diagrams also indicate (with shading) areas with at least three usable signals, but where all possible combinations of three signals yield a geometric dilution of precision which is above the prescribed threshold value of one kilometer of radial position error per centicycle of line-of-position phase error.

In all diagrams, the receiver noise bandwidth is assumed to be 100 Hz and the radiated power of each transmitting station is taken to be 10 kW. The key for locating a composite coverage diagram at a selected time and signal access criterion is given in the Table of Contents.

METRIC CONVERSION FACTORS

Approximate Conversions to Metric Measures

Symbol	When You Know	Multiply by	To Find	Symbol
LENGTH				
in	inches	2.5	centimeters	cm
ft	feet	30	centimeters	cm
y	yards	0.9	meters	m
m	miles	1.6	kilometers	km
AREA				
sq in	square inches	6.5	square centimeters	cm ²
sq ft	square feet	0.09	square meters	m ²
sq yd	square yards	0.8	square meters	m ²
sq mi	square miles	2.6	square kilometers	km ²
acre	acres	0.4	hectares	ha
MASS (weight)				
oz	ounces	28	grams	g
lb	pounds	0.45	kilograms	kg
short ton	short tons	0.9	tonnes	t
(2000 lb)				
VOLUME				
teaspoon	teaspoons	5	milliliters	ml
tablespoon	tablespoons	15	milliliters	ml
fluid ounce	fluid ounces	30	milliliters	ml
cup	cups	0.24	liters	l
pint	pints	0.47	liters	l
quart	quarts	0.95	liters	l
gallon	gallons	3.8	liters	l
cubic foot	cubic feet	0.03	cubic meters	m ³
cubic yard	cubic yards	0.76	cubic meters	m ³
TEMPERATURE (Celsius)				
°F	Fahrenheit temperature	5/9 (after subtracting 32)	Celsius temperature	°C

*1 oz = 2.54 (exactly). For other exact conversions and more detailed tables, see NIST Mon. Publ. 285, Units of Weight and Measure, Price \$2.25, SD Catalog No. C13.10-285.

Approximate Conversions from Metric Measures

When You Know	Multiply by	To Find	Symbol
LENGTH			
millimeters	0.04	inches	in
centimeters	0.4	inches	in
meters	3.3	feet	ft
meters	1.1	yards	y
kilometers	0.6	miles	mi
AREA			
square centimeters	0.16	square inches	in ²
square meters	1.2	square yards	sq yd
square kilometers	0.4	square miles	sq mi
hectares (10,000 m ²)	2.5	acres	ac
MASS (weight)			
grams	0.035	ounces	oz
kilograms	2.2	pounds	lb
tonnes (1000 kg)	1.1	short tons	st
VOLUME			
milliliters	0.03	fluid ounces	fl oz
liters	2.1	pints	pt
liters	1.06	quarts	qt
liters	0.26	gallons	gal
cubic meters	35	cubic feet	cu ft
cubic meters	1.3	cubic yards	cu yd
TEMPERATURE (Celsius)			
Celsius temperature	9/5 (then add 32)	Fahrenheit temperature	°F

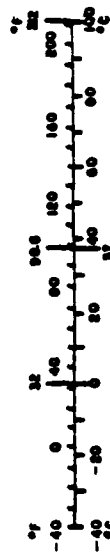


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Composite 10.2 kHz Signal Coverage Prediction Diagrams

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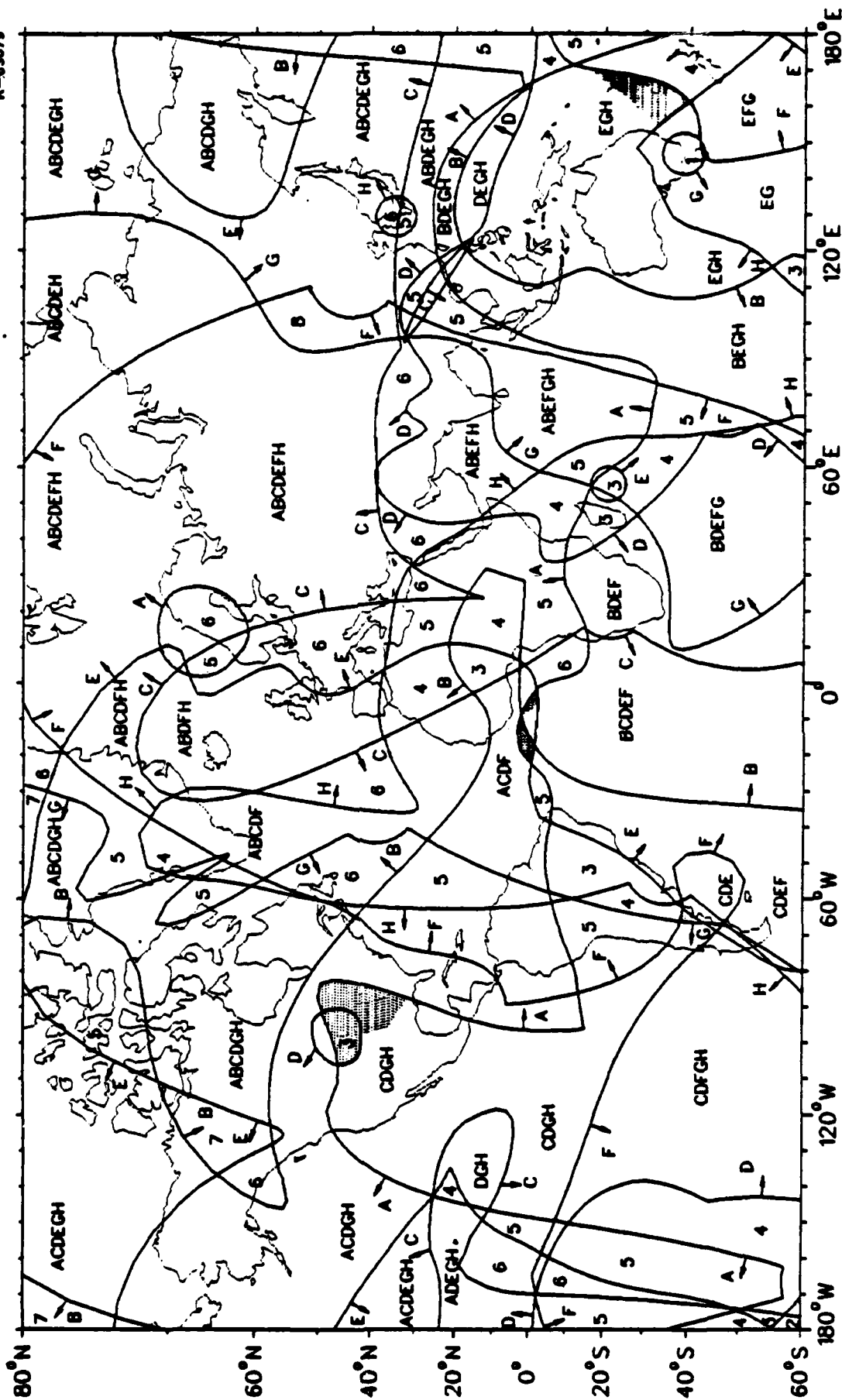
<u>Coverage Time</u>		<u>Signal</u>		
<u>Month</u>	<u>GMT</u>	<u>Access</u>	<u>Projection</u>	<u>Page No.</u>
February	0600	I	Mercator	1
			AED (N Pole)	2
			AED (S Pole)	3
		II	Mercator	4
			AED (N Pole)	5
			AED (S Pole)	6
	1800	I	Mercator	7
			AED (N Pole)	8
			AED (S Pole)	9
		II	Mercator	10
			AED (N Pole)	11
			AED (S Pole)	12
May	0600	I	Mercator	13
			AED (N Pole)	14
			AED (S Pole)	15
		II	Mercator	16
			AED (N Pole)	17
			AED (S Pole)	18
	1800	I	Mercator	19
			AED (N Pole)	20
			AED (S Pole)	21
		II	Mercator	22
			AED (N Pole)	23
			AED (S Pole)	24
August	0600	I	Mercator	25
			AED (N Pole)	26
			AED (S Pole)	27
		II	Mercator	28
			AED (N Pole)	29
			AED (S Pole)	30

TABLE OF CONTENTS (Continued)

<u>Coverage Time</u>		<u>Signal</u>		
<u>Month</u>	<u>GMT</u>	<u>Access</u>	<u>Projection</u>	<u>Page No.</u>
August (Cont.)	1800	I	Mercator	31
			AED (N Pole)	32
			AED (S Pole)	33
		II	Mercator	34
			AED (N Pole)	35
			AED (S Pole)	36
November	0600	I	Mercator	37
			AED (N Pole)	38
			AED (S Pole)	39
		II	Mercator	40
			AED (N Pole)	41
			AED (S Pole)	42
	1800	I	Mercator	43
			AED (N Pole)	44
			AED (S Pole)	45
		II	Mercator	46
			AED (N Pole)	47
			AED (S Pole)	48

-20 dB SNR

1

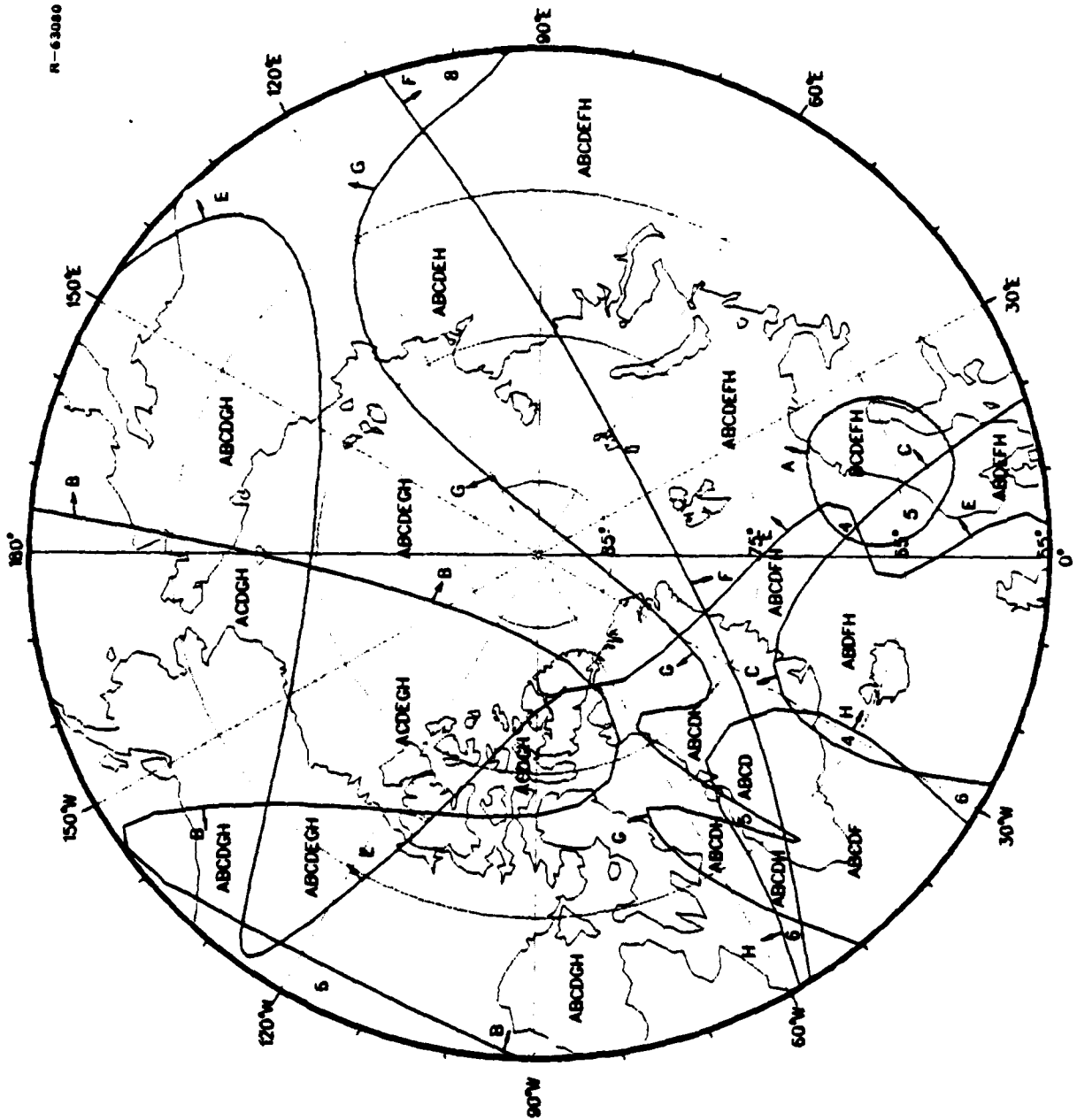


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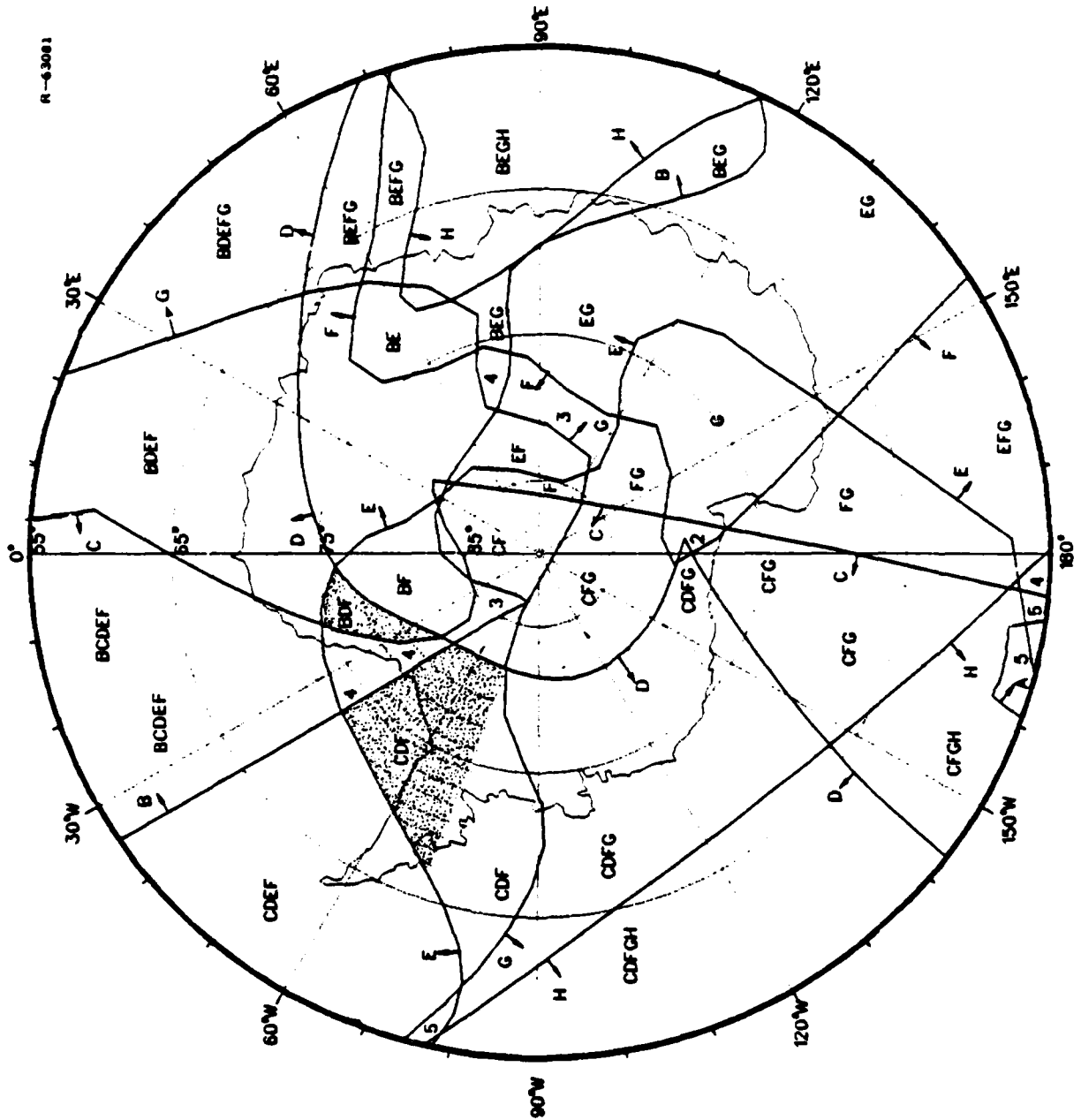
-20 dB SNR

FEBRUARY

0600 GMT



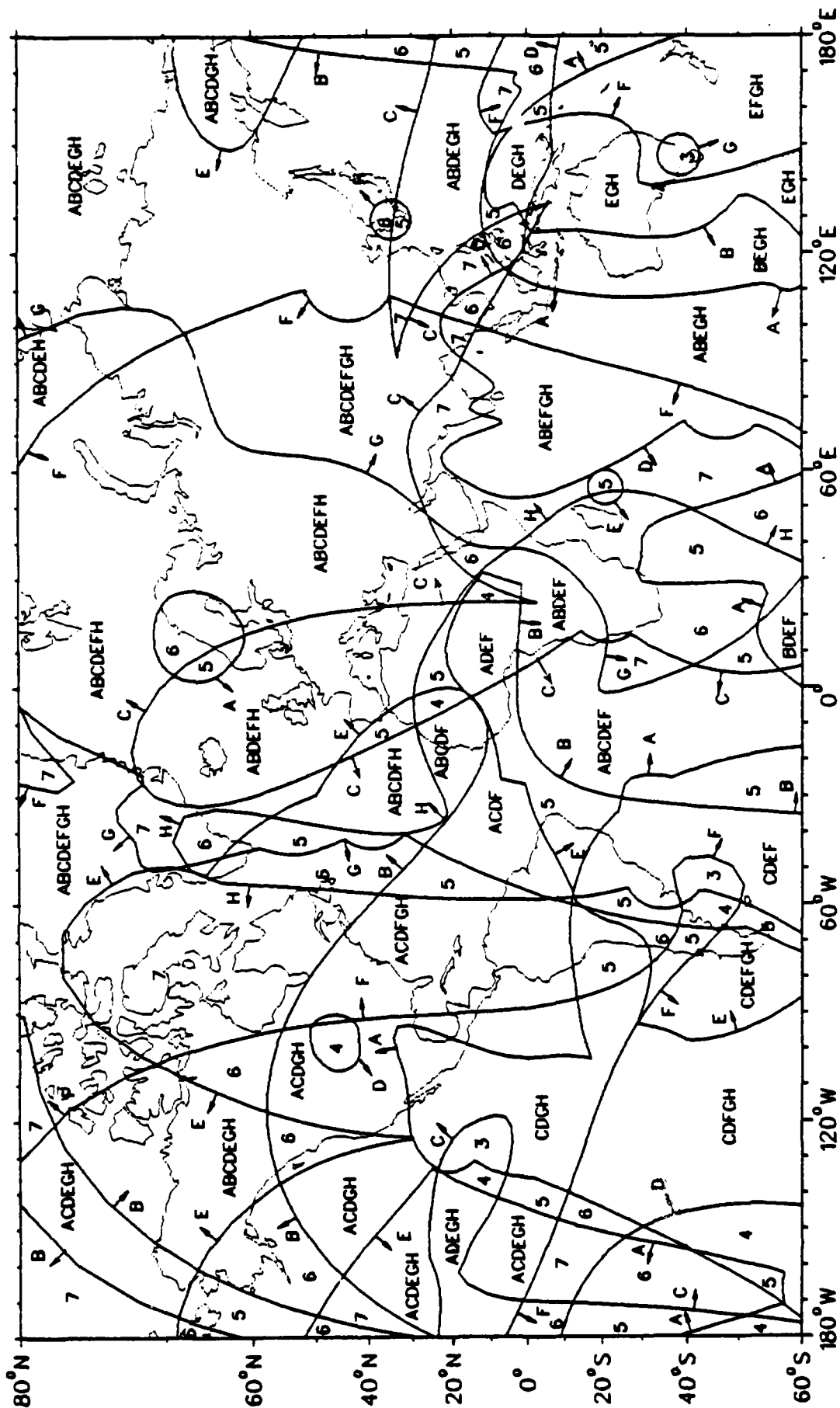
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-20 dB SNR
FEBRUARY
0600 GMT



R-33081

-30 dB SNR FEBRUARY 0600 GMT

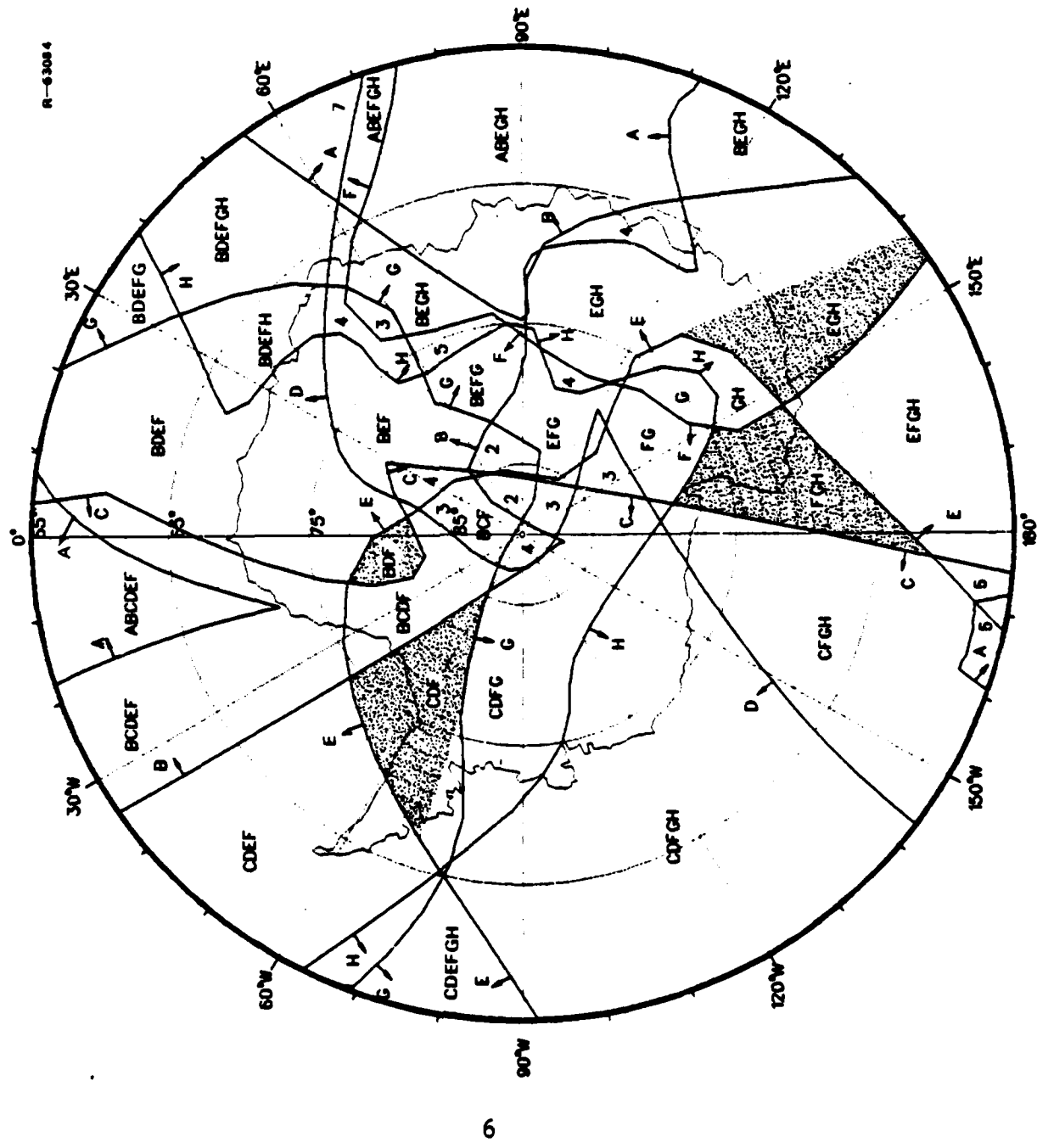
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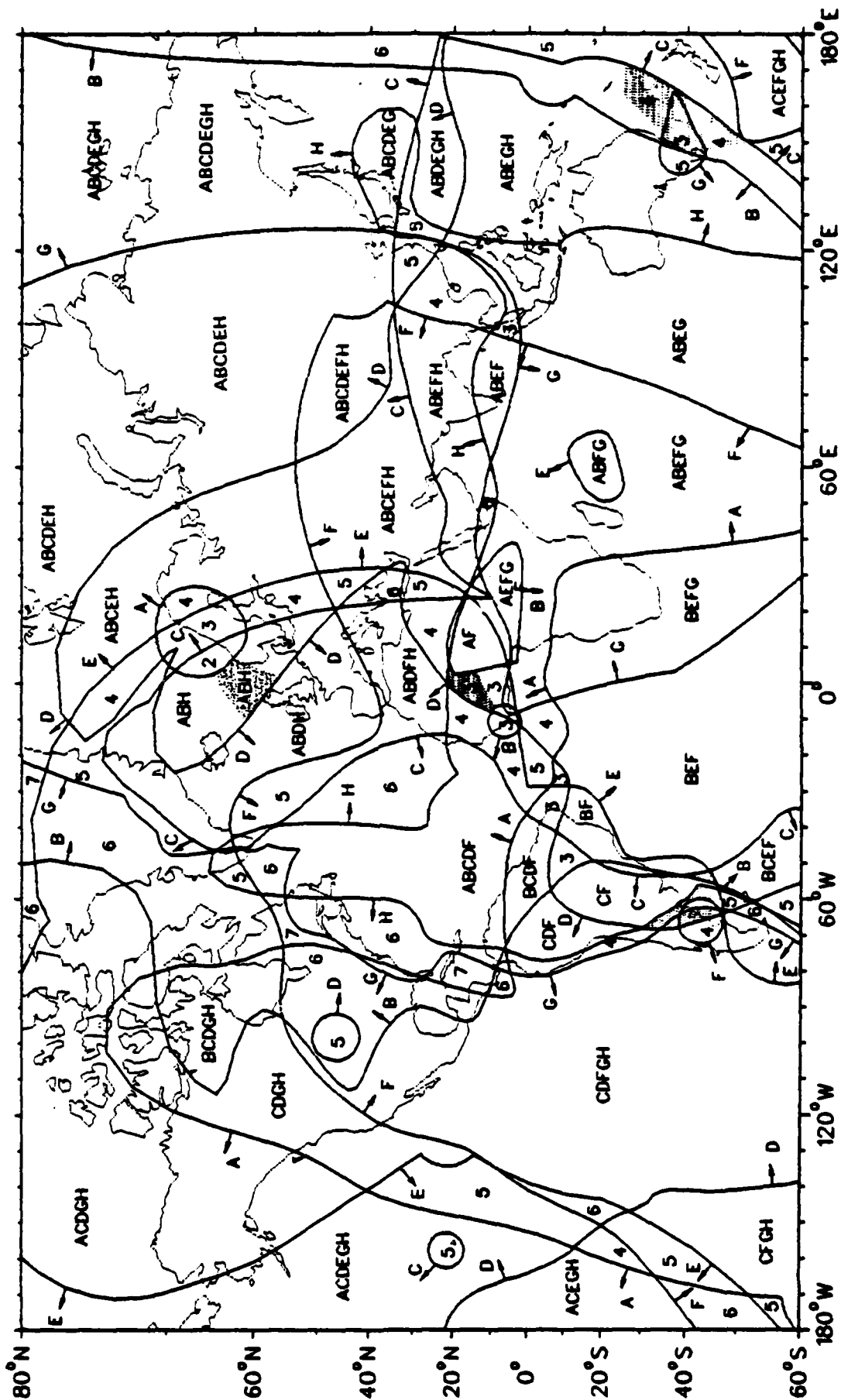
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R-83084

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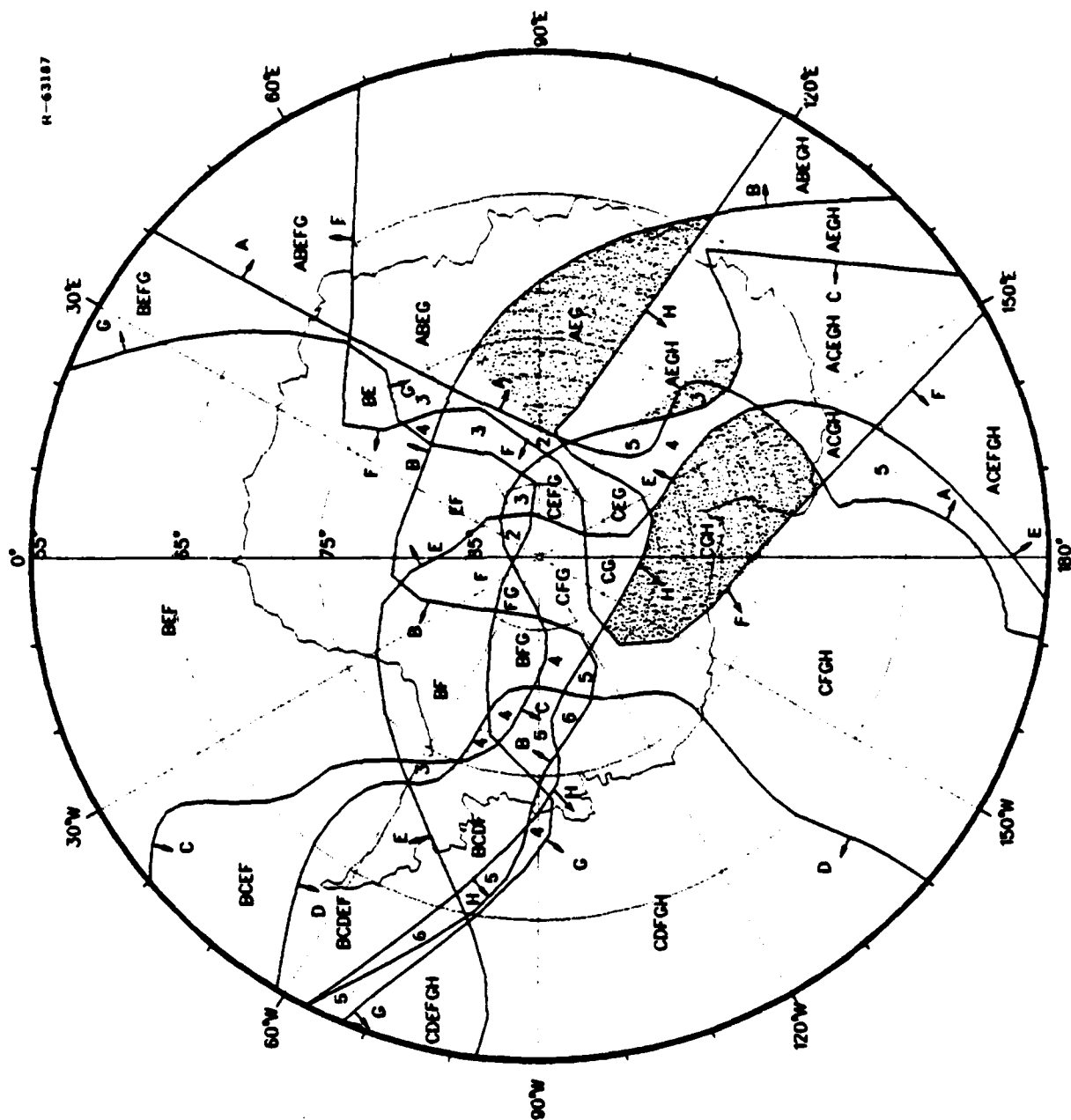
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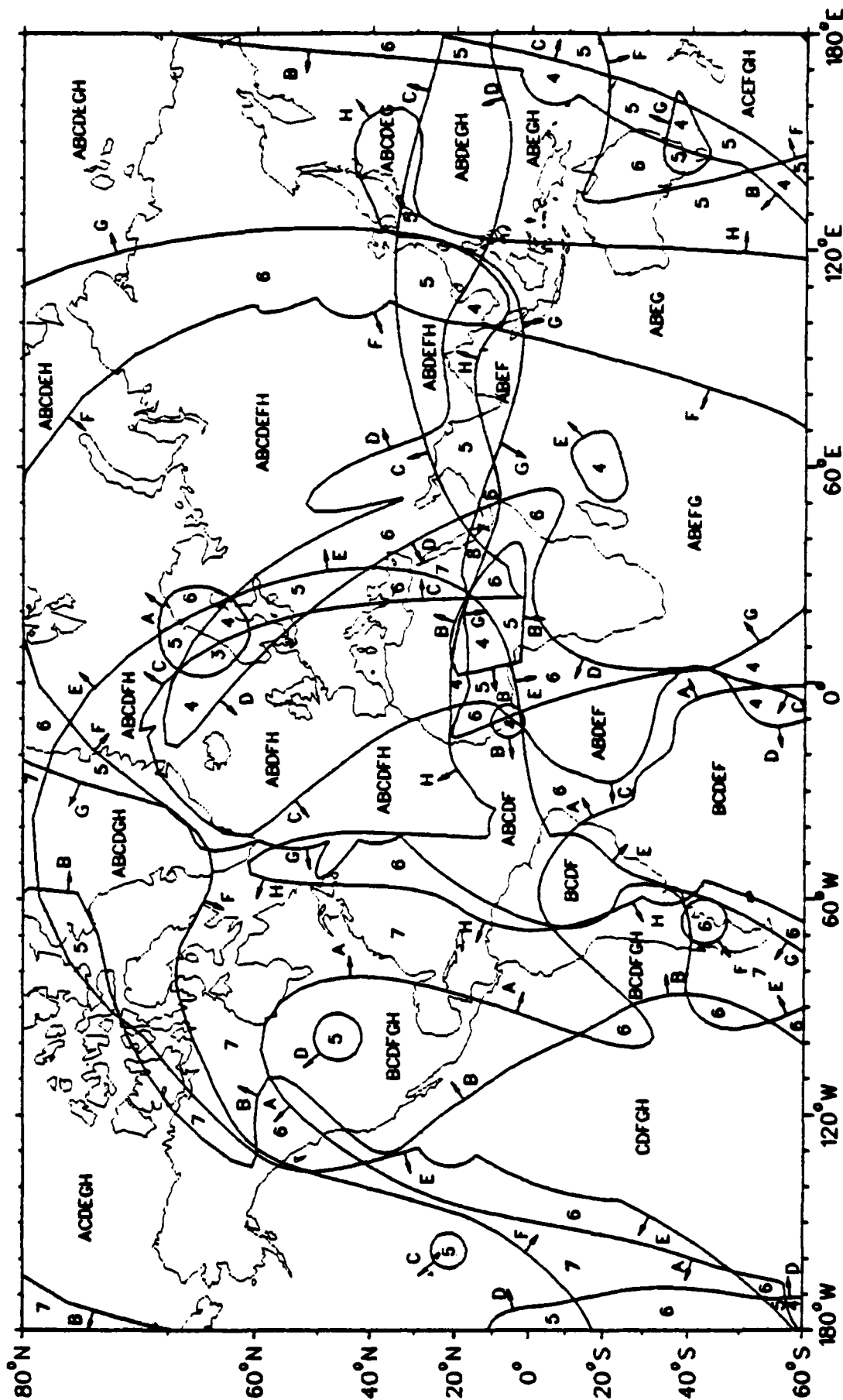


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-20 dB SNR
FEBRUARY
1800 GMT



N-63187

R-63075

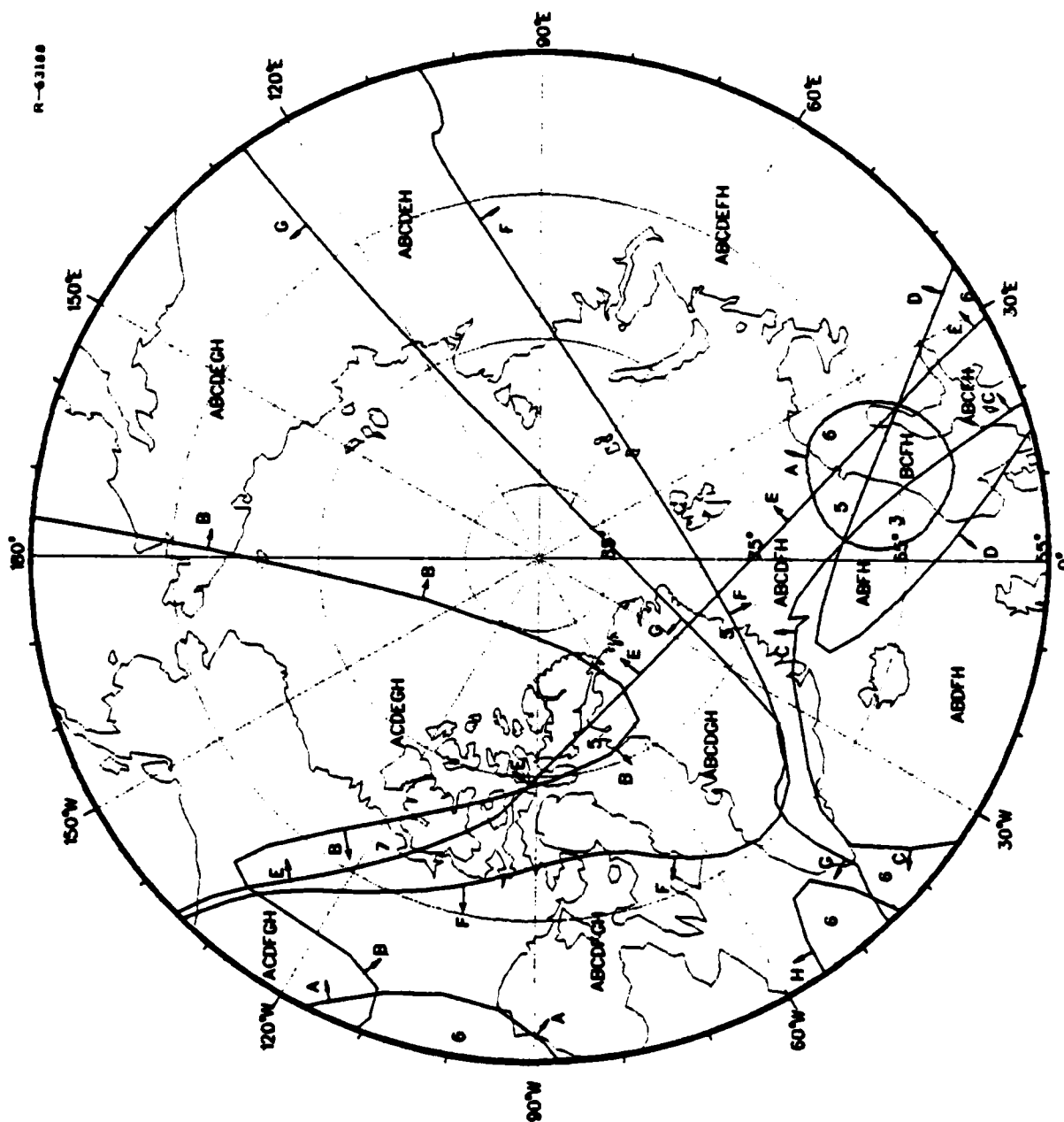


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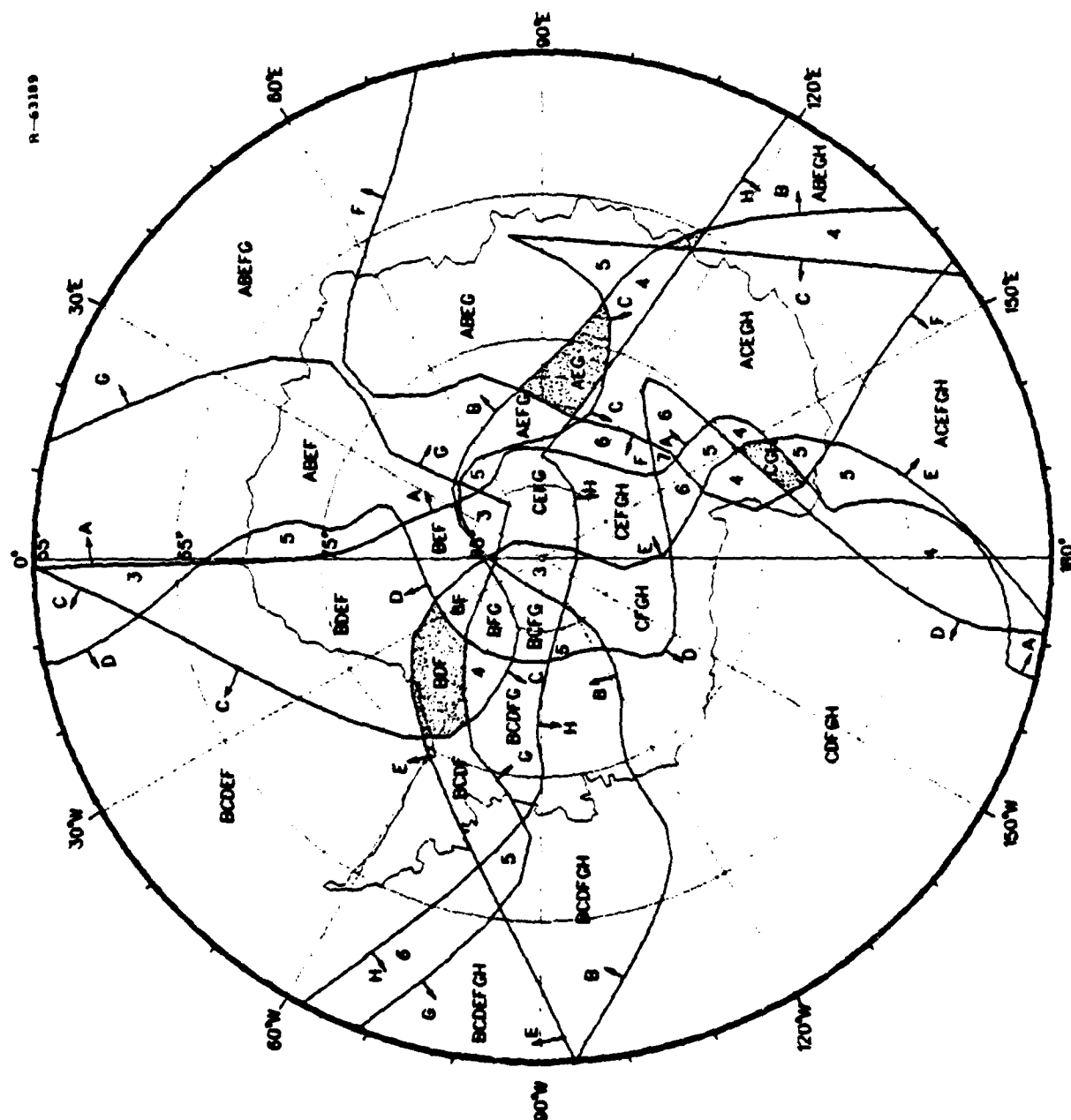
-30 dB SNR

FEBRUARY

1800 GMT

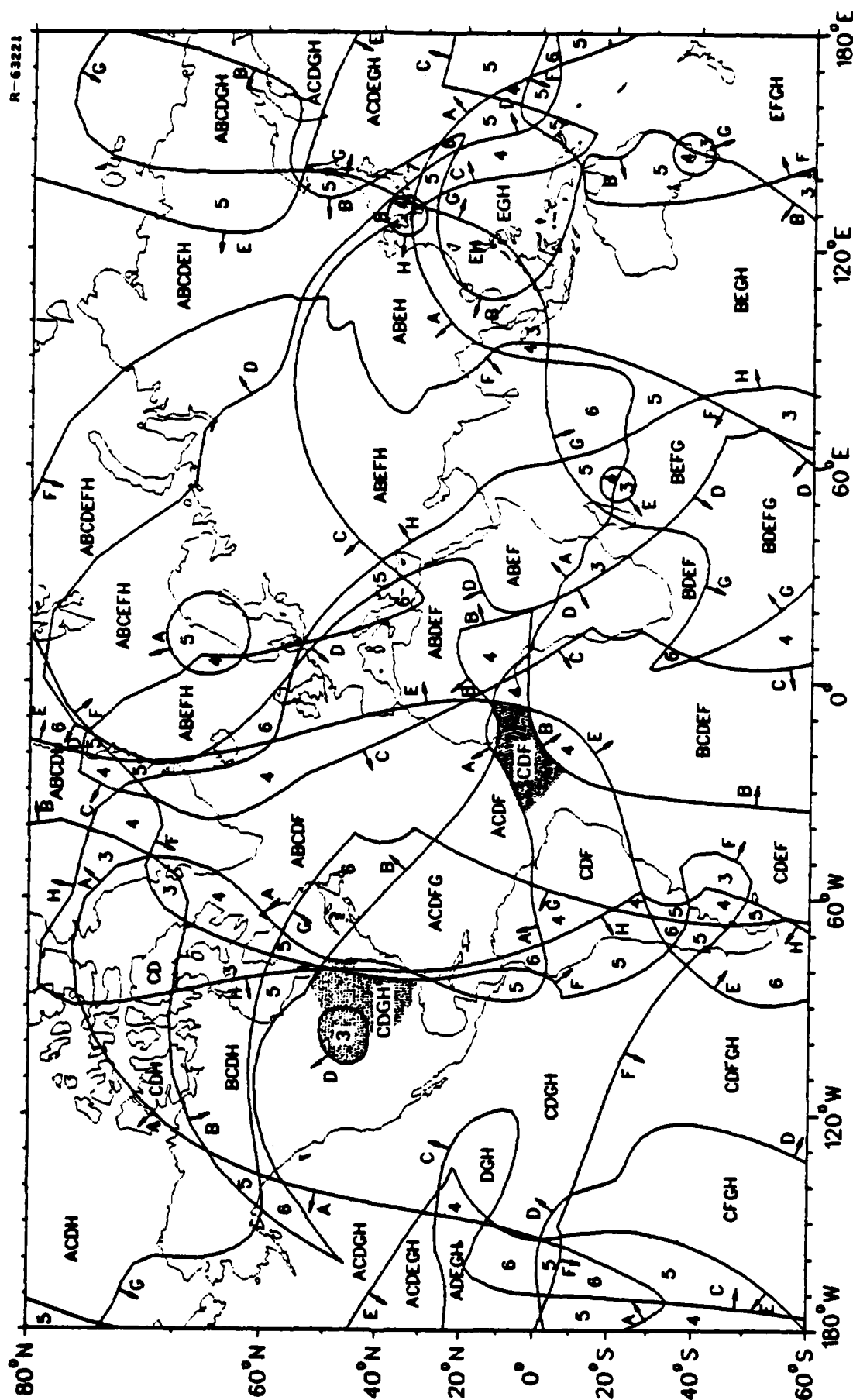


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-30 dB SNR
FEBRUARY
1800 GMT



R-63189

-20 dB SNR

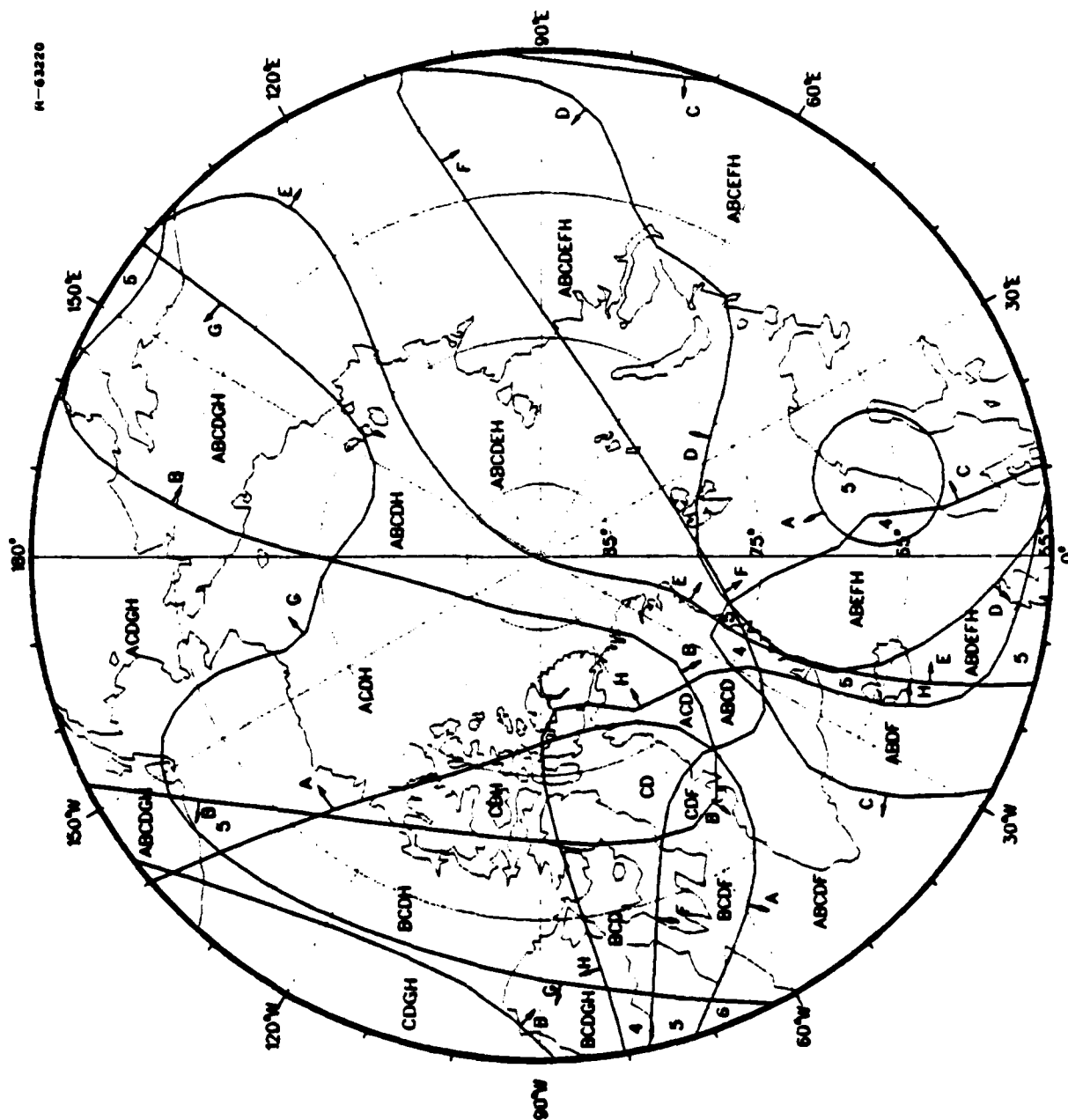


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-20 dB SNR

MAY

0600 GMT

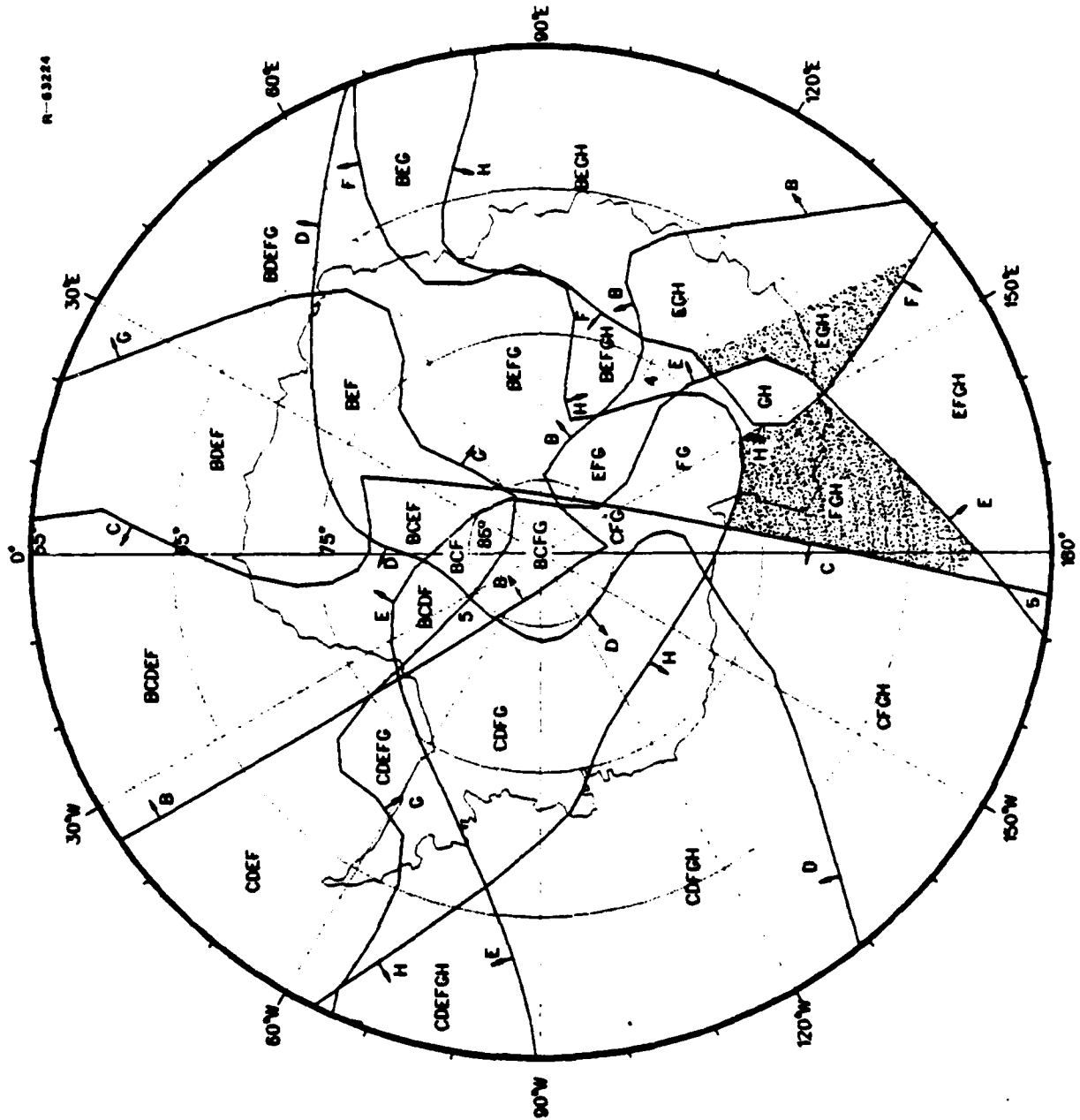


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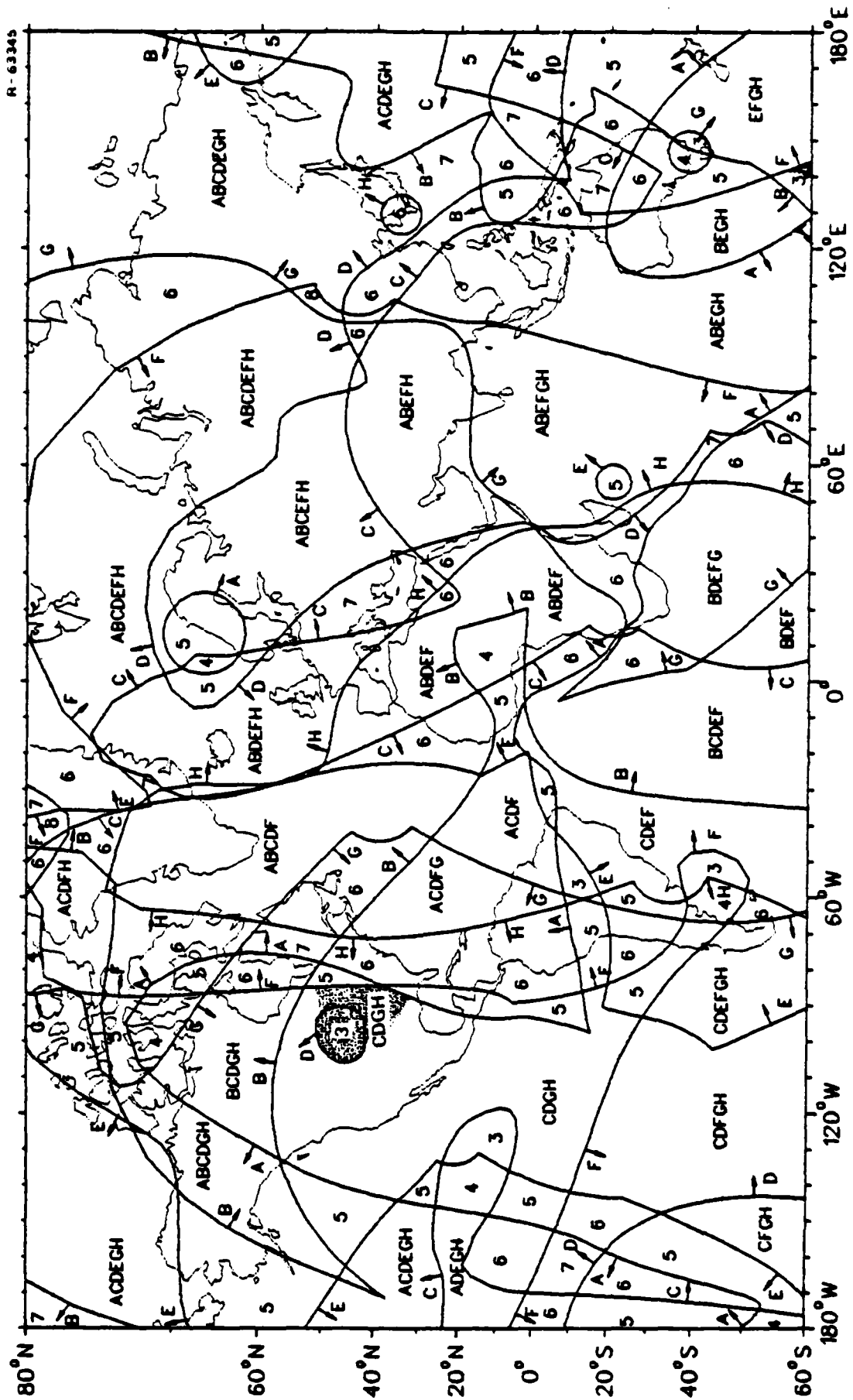
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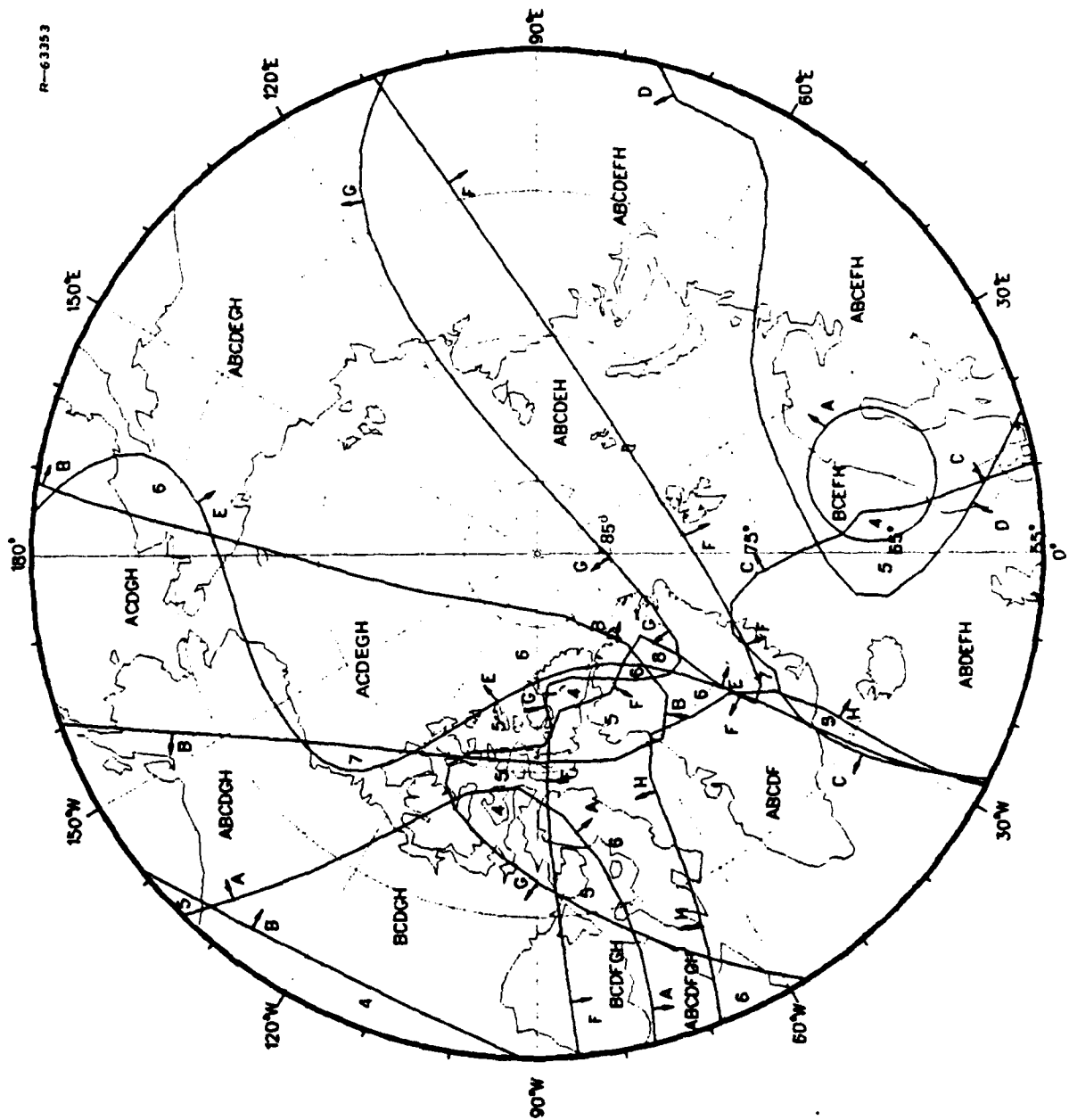
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-30 dB SNR MAY 0600 GMT



0600 GMT

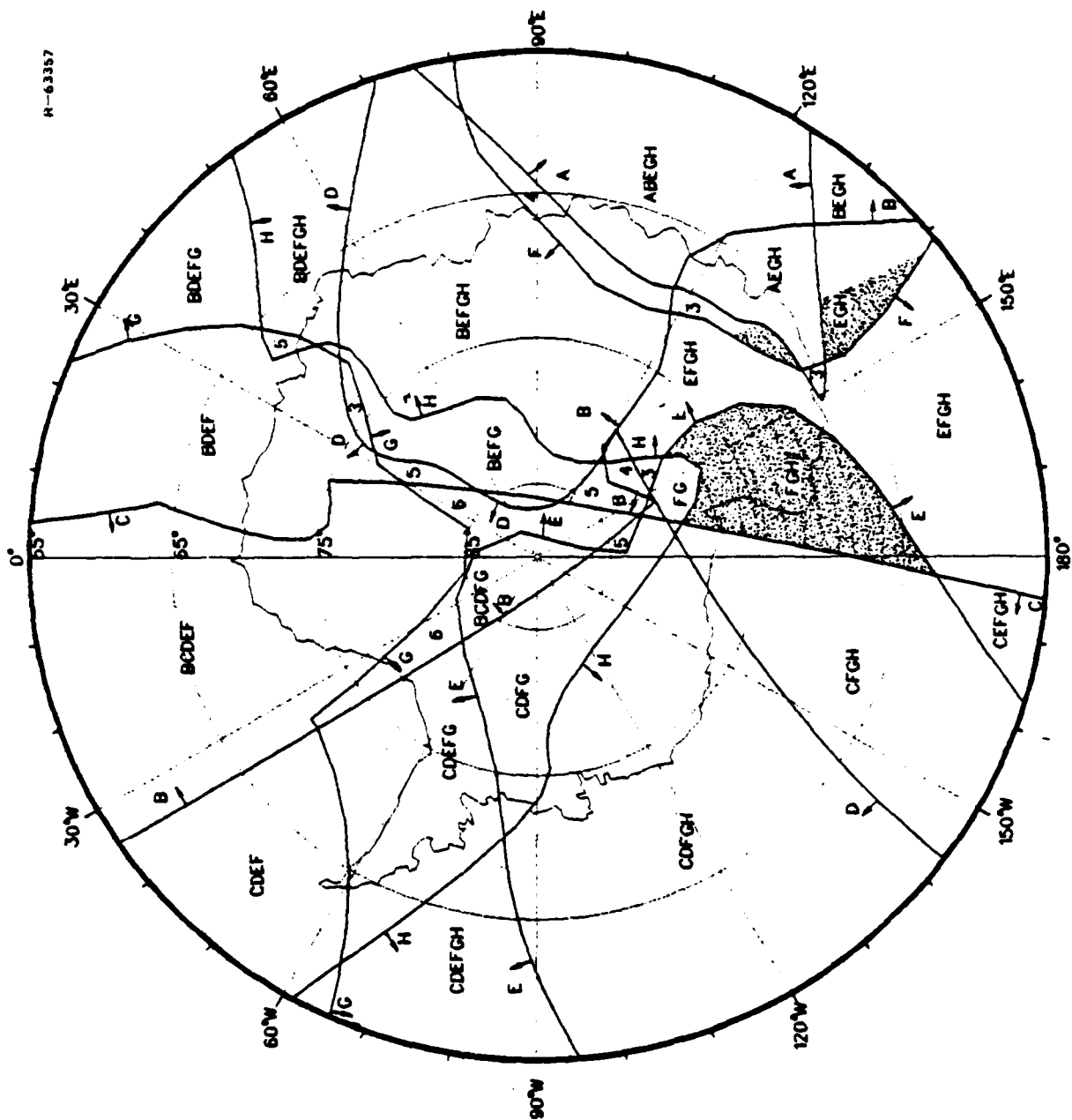


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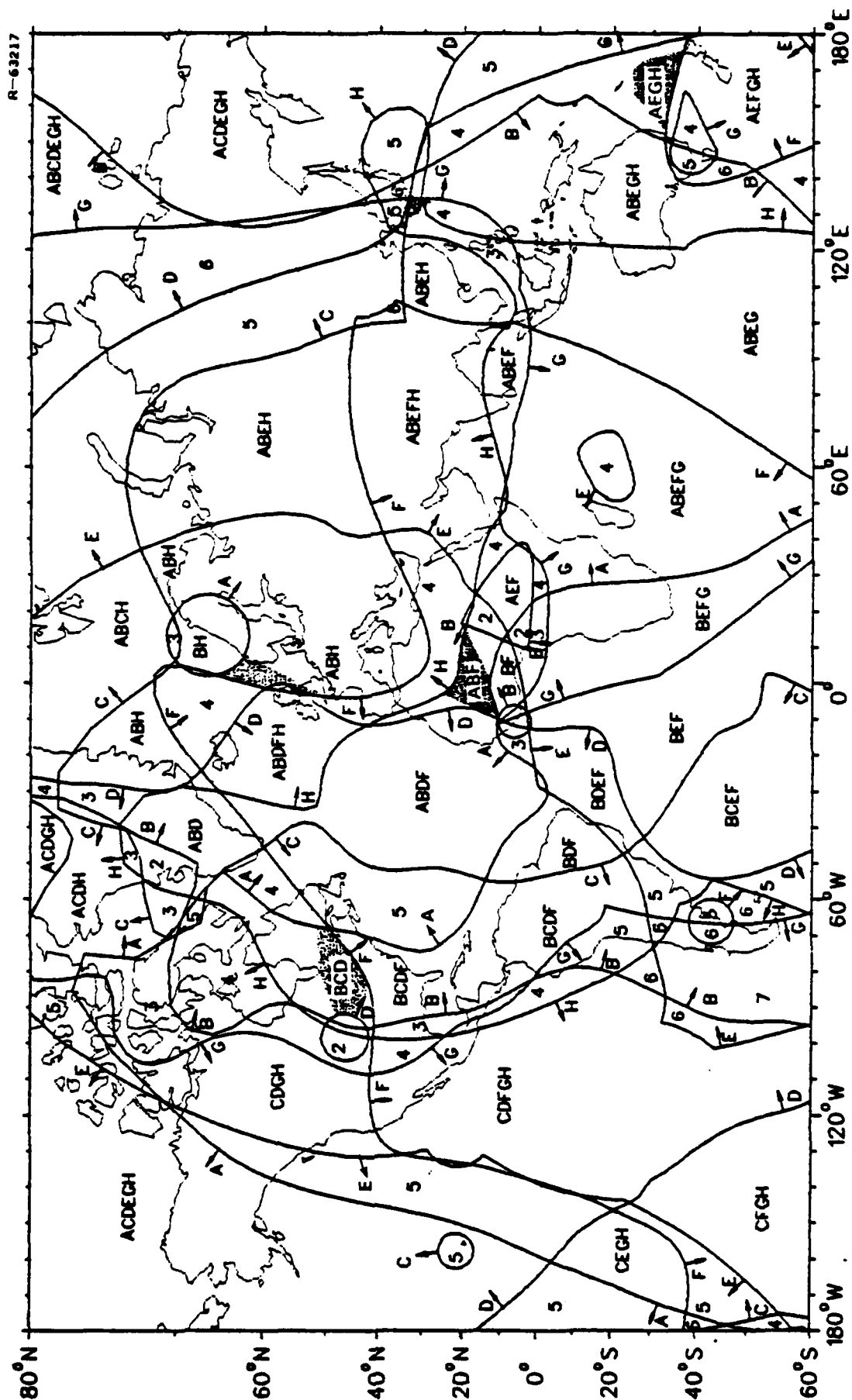
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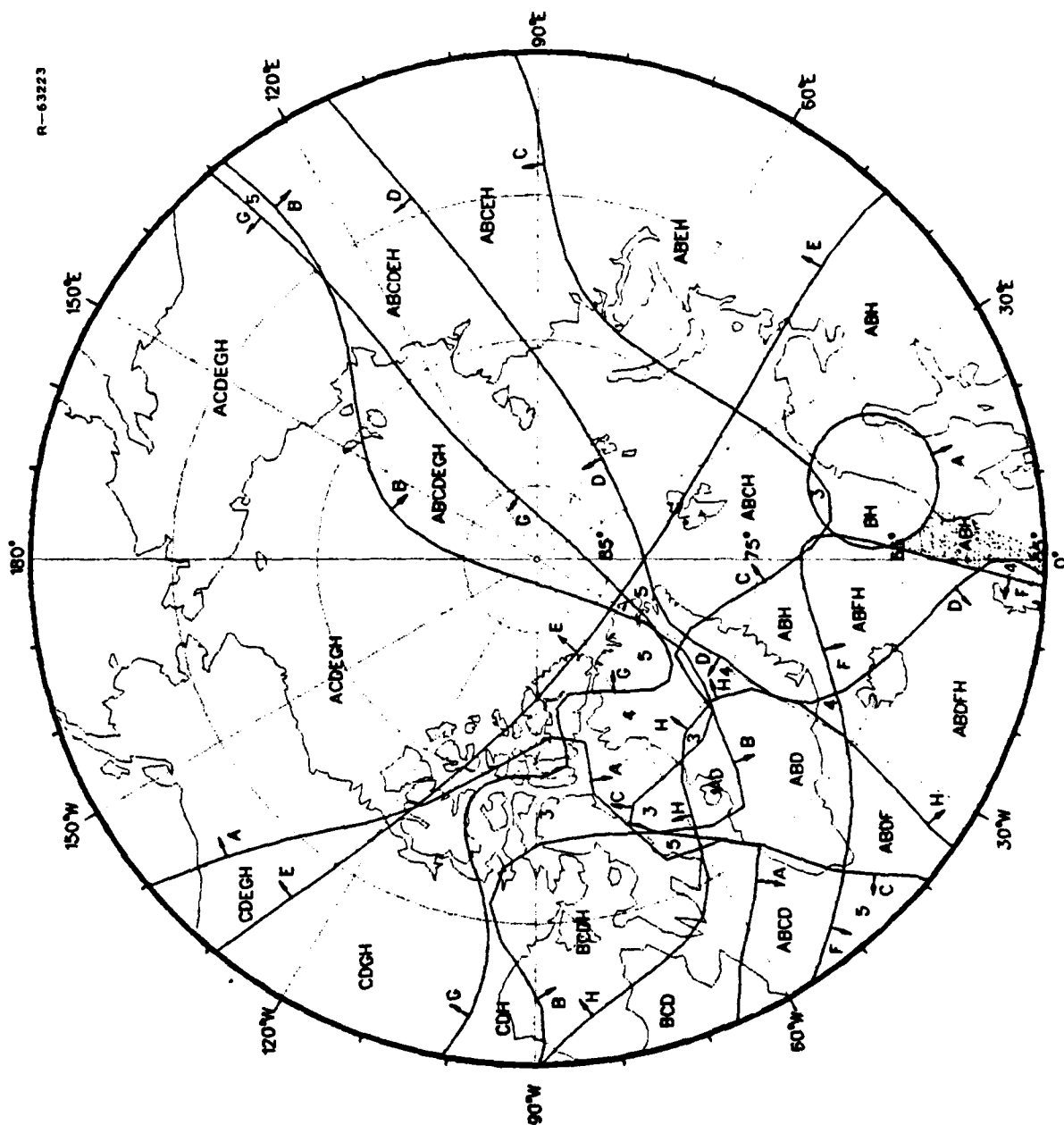
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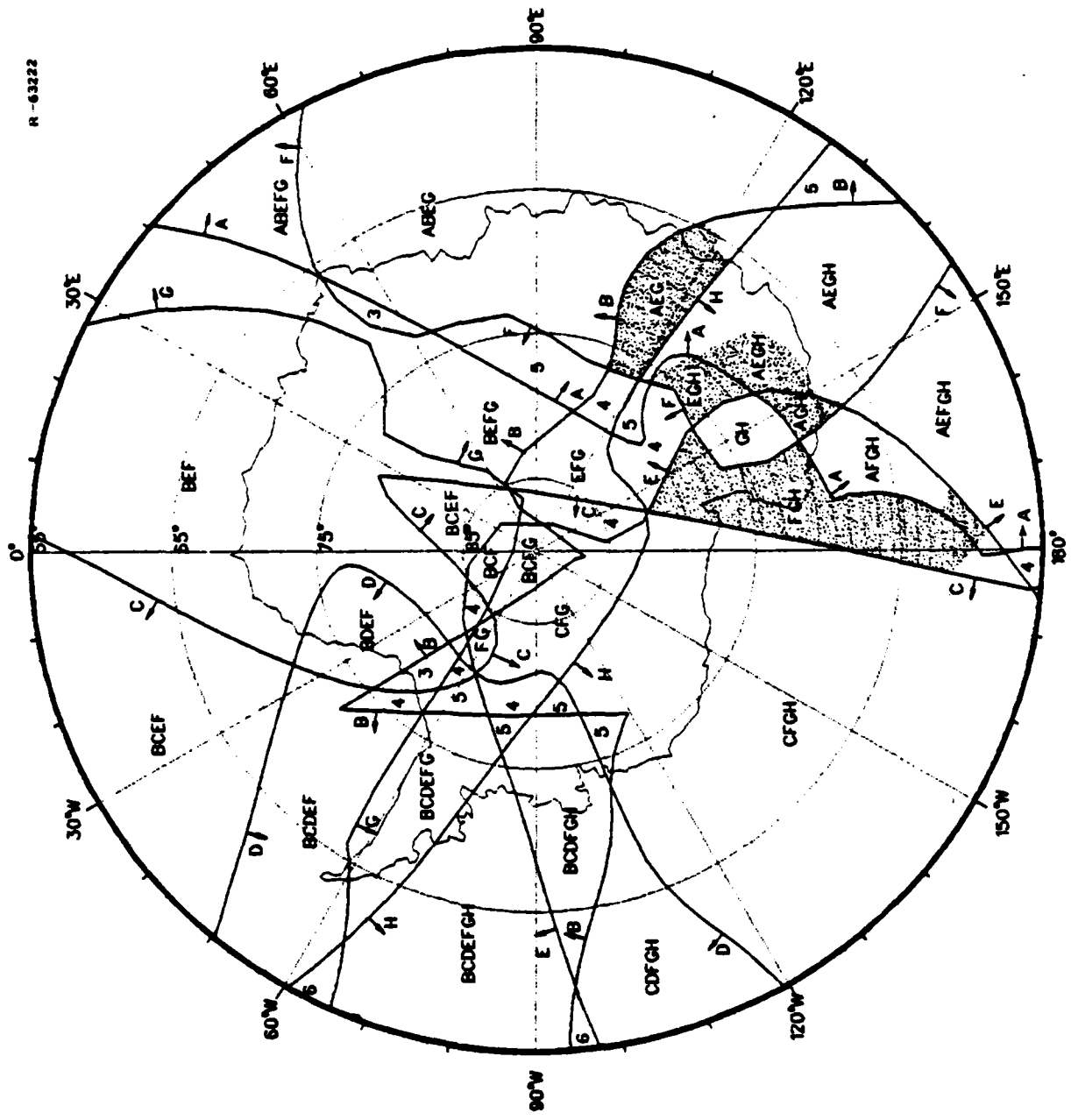
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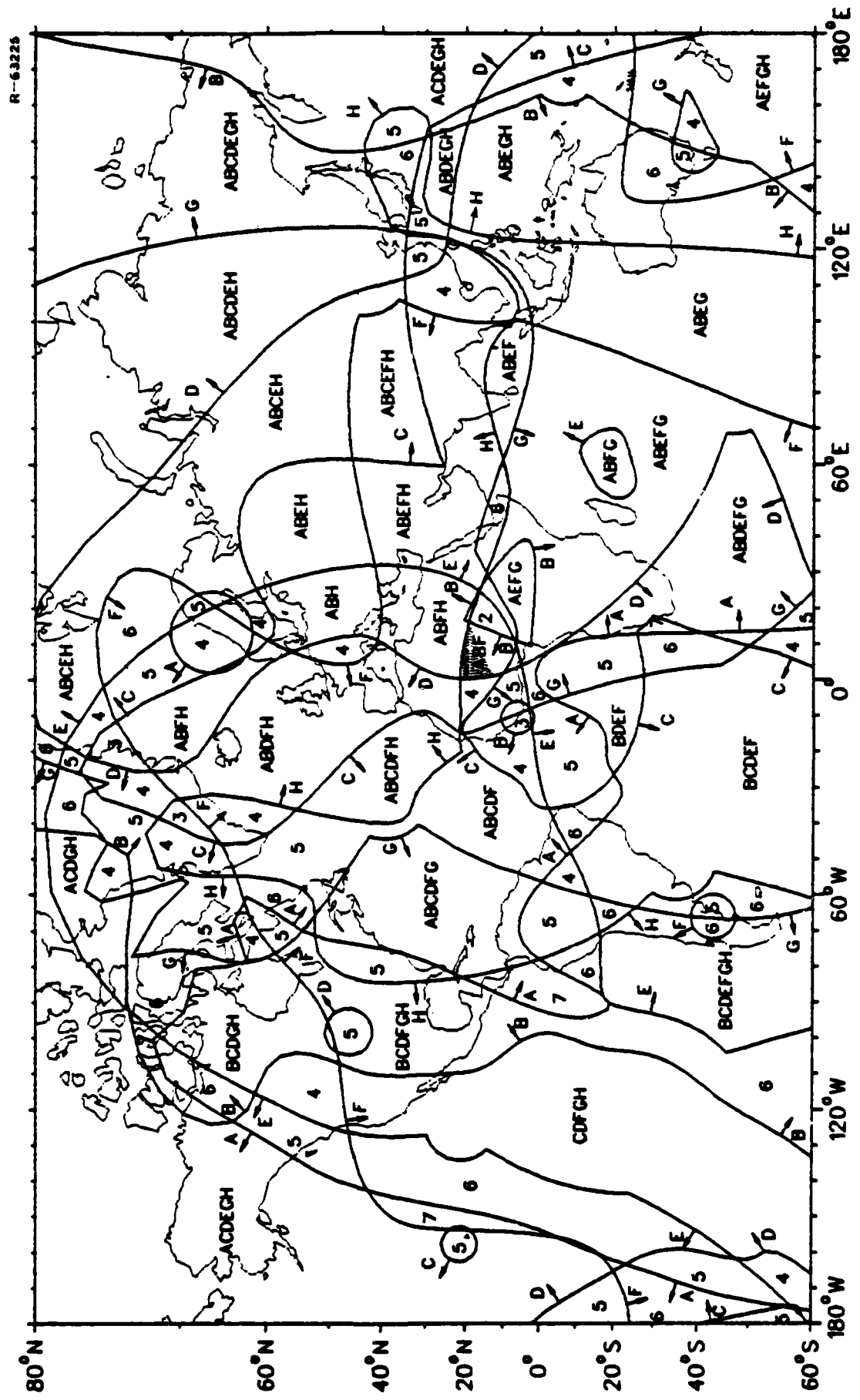


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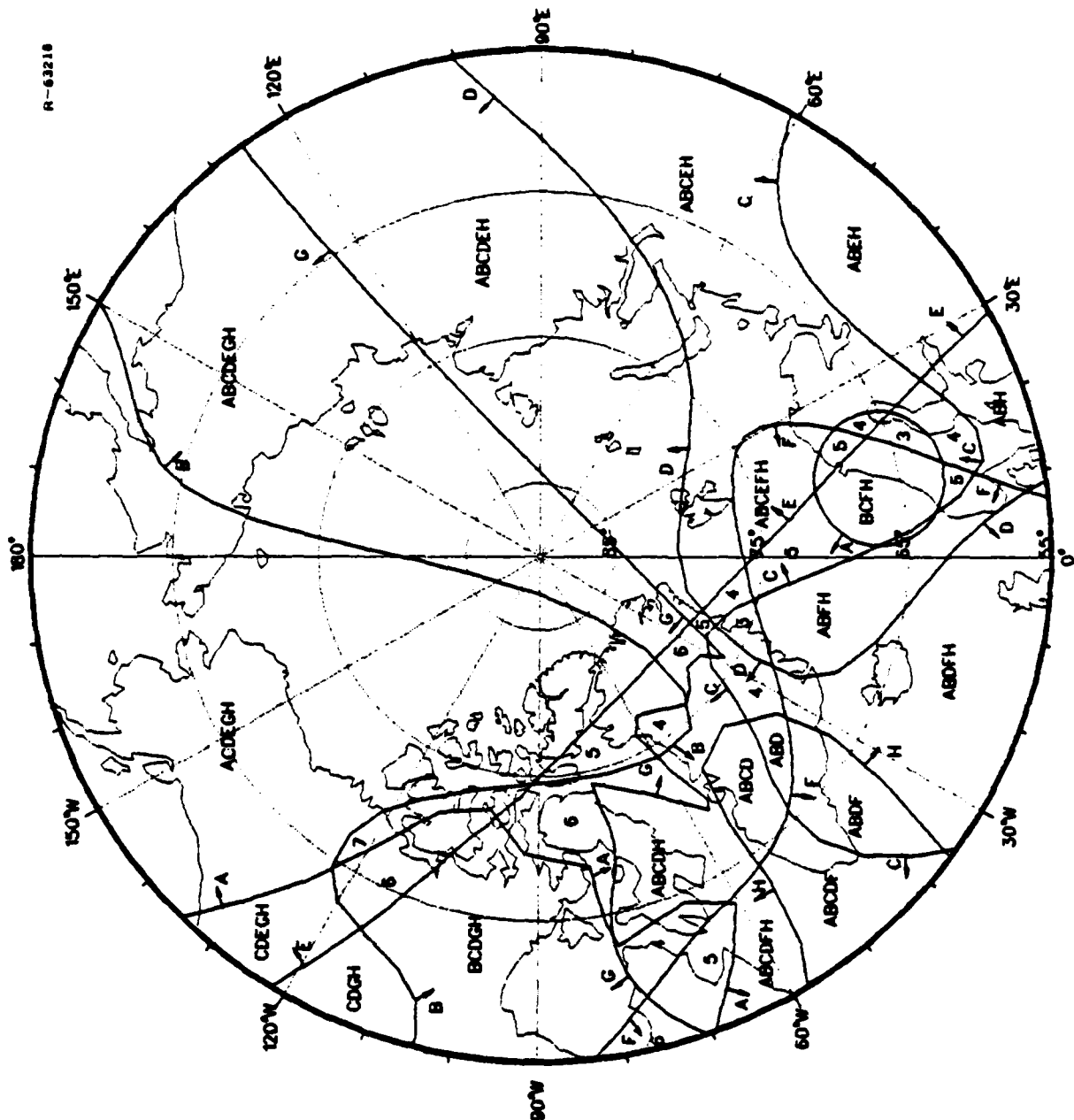


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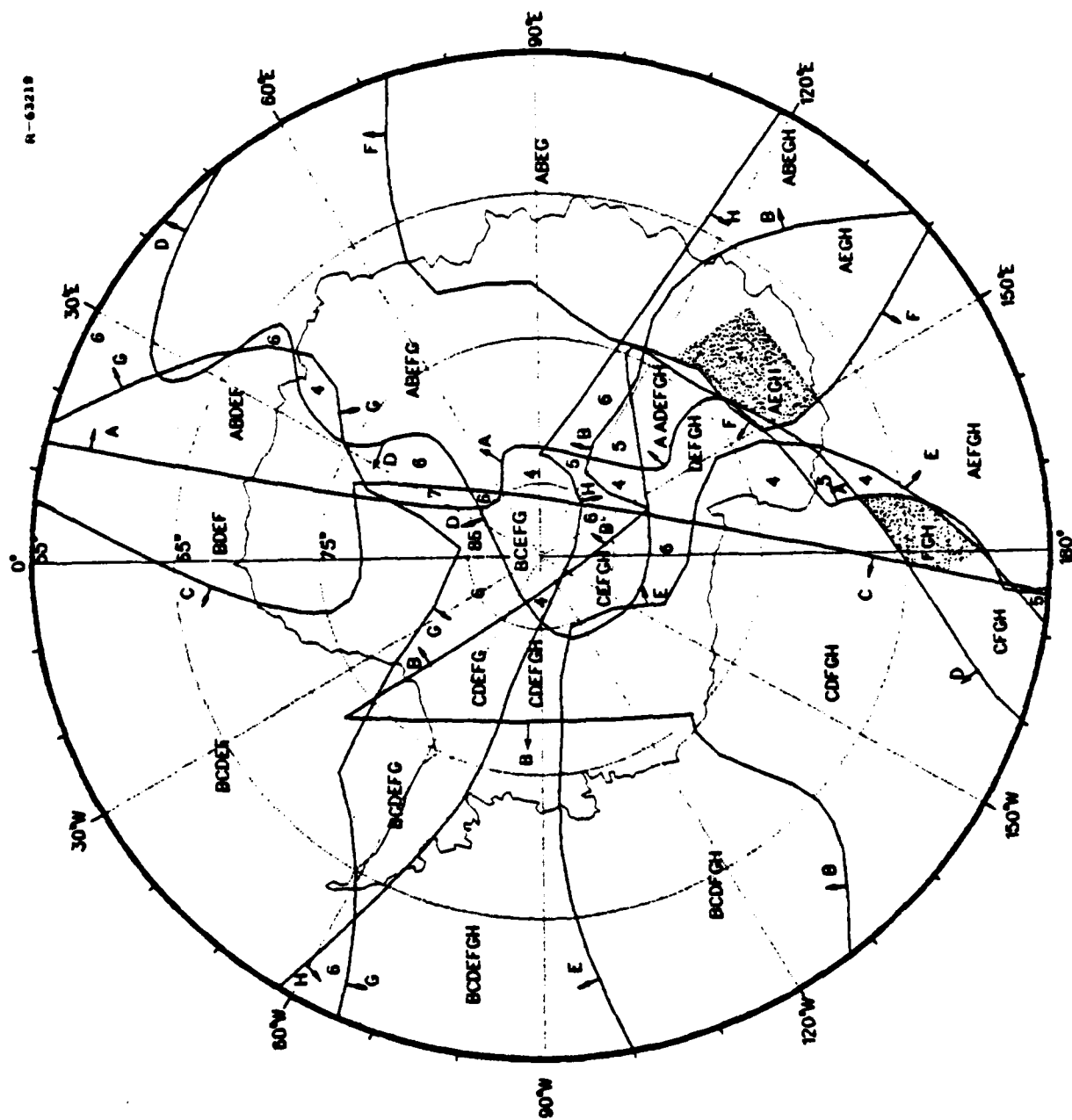


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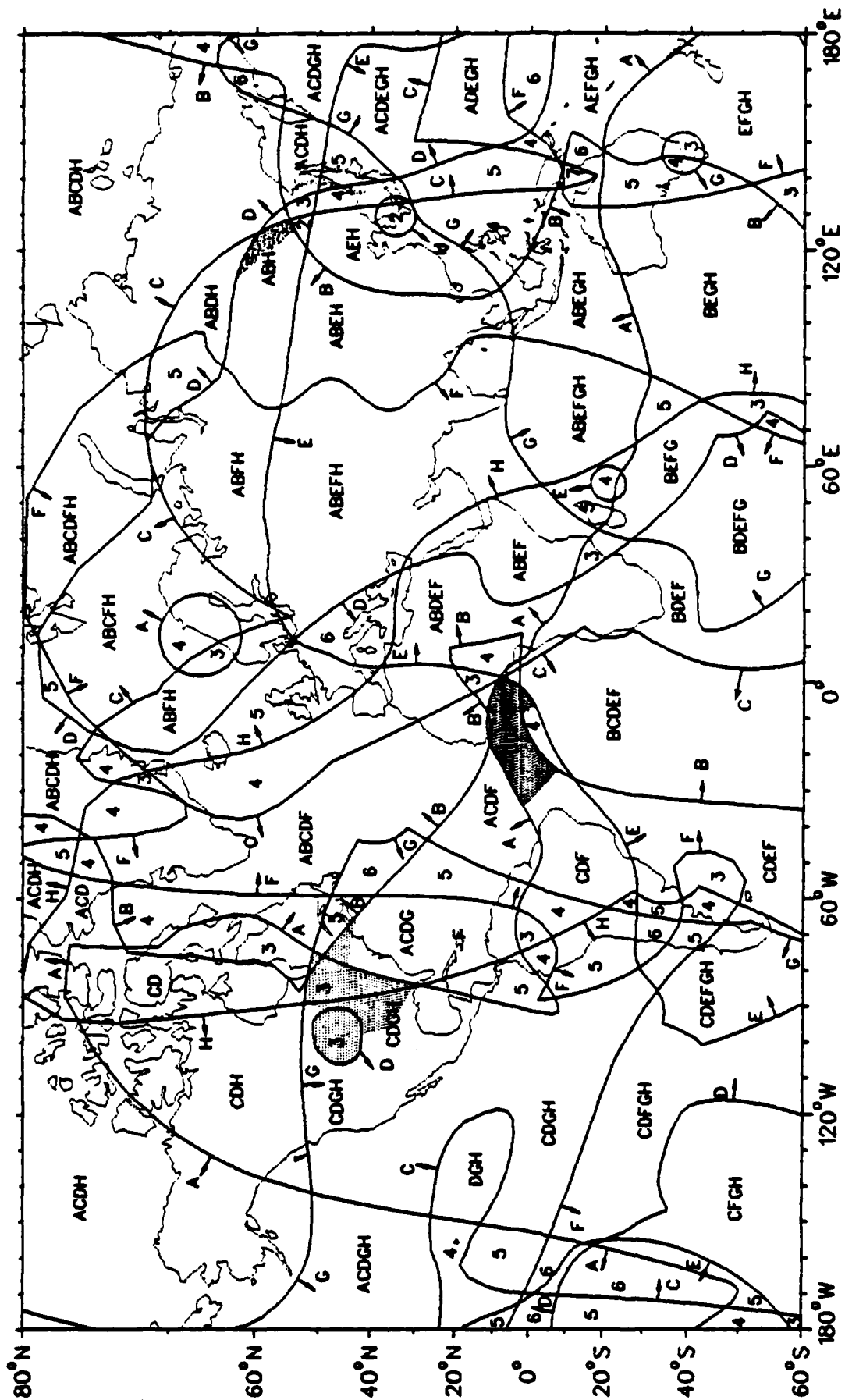
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R-63218

-20 dB SNR AUGUST 0600 GMT

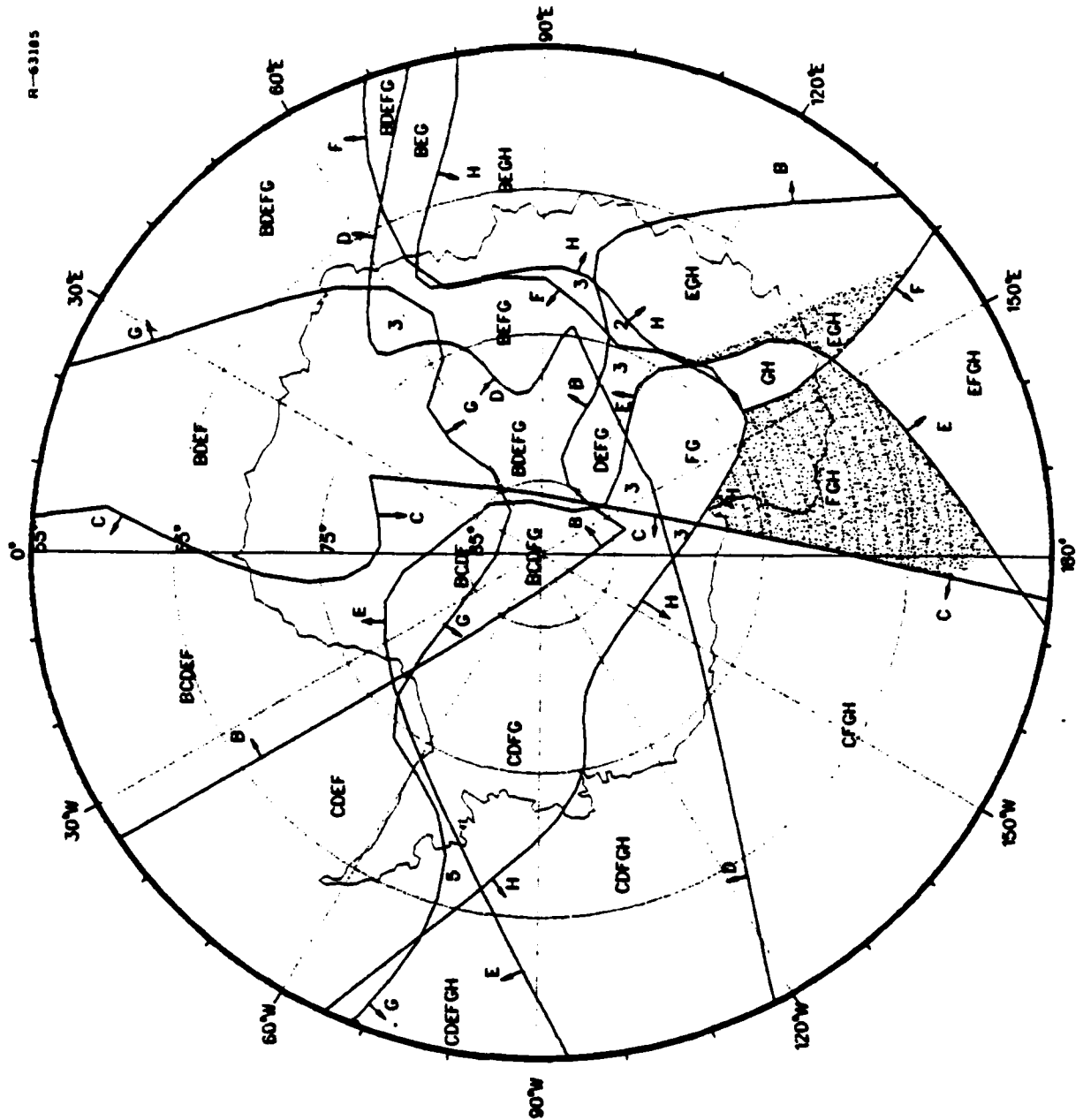
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AUGUST
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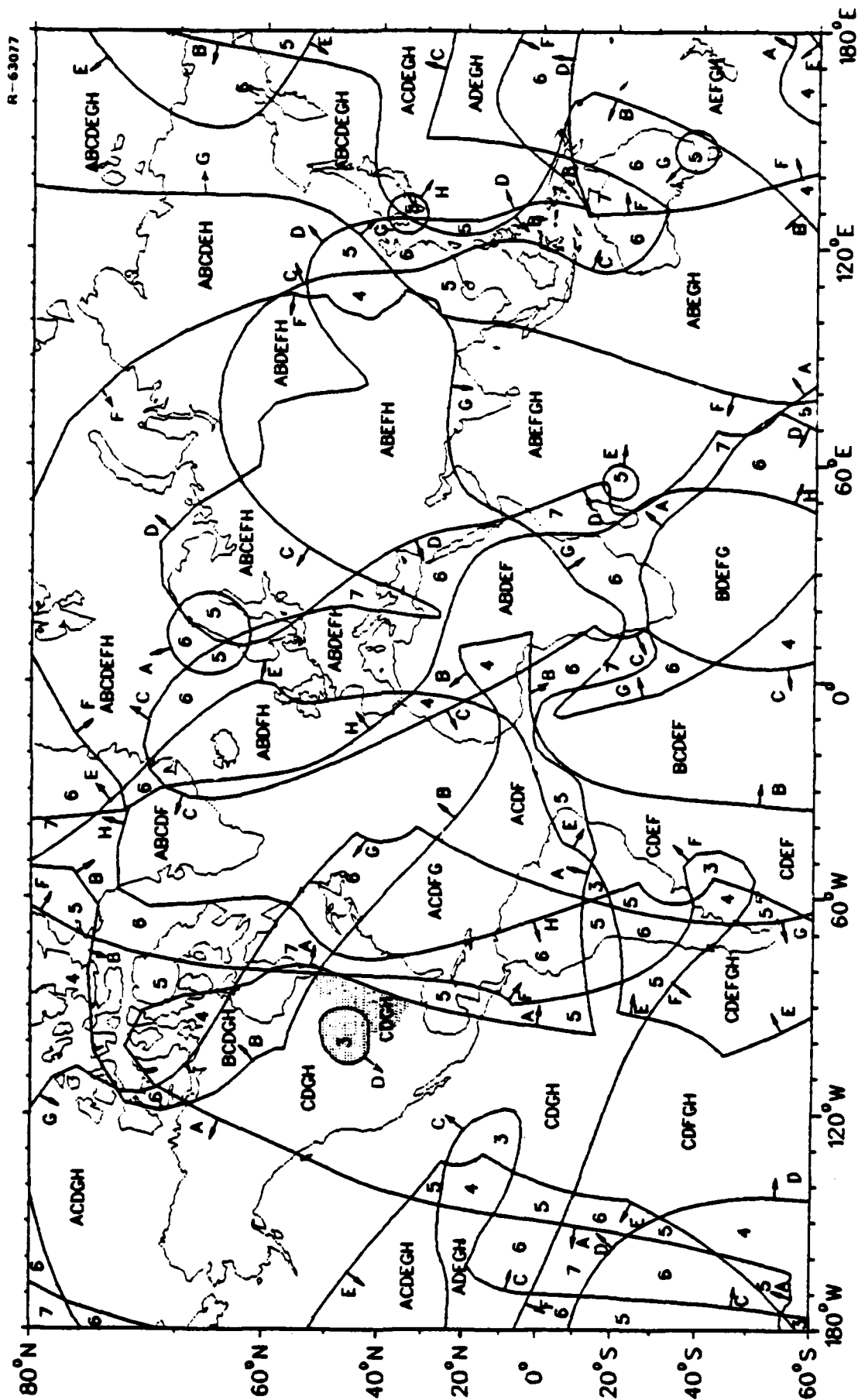
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-30 dB SNR

AUGUST

0600 GMT



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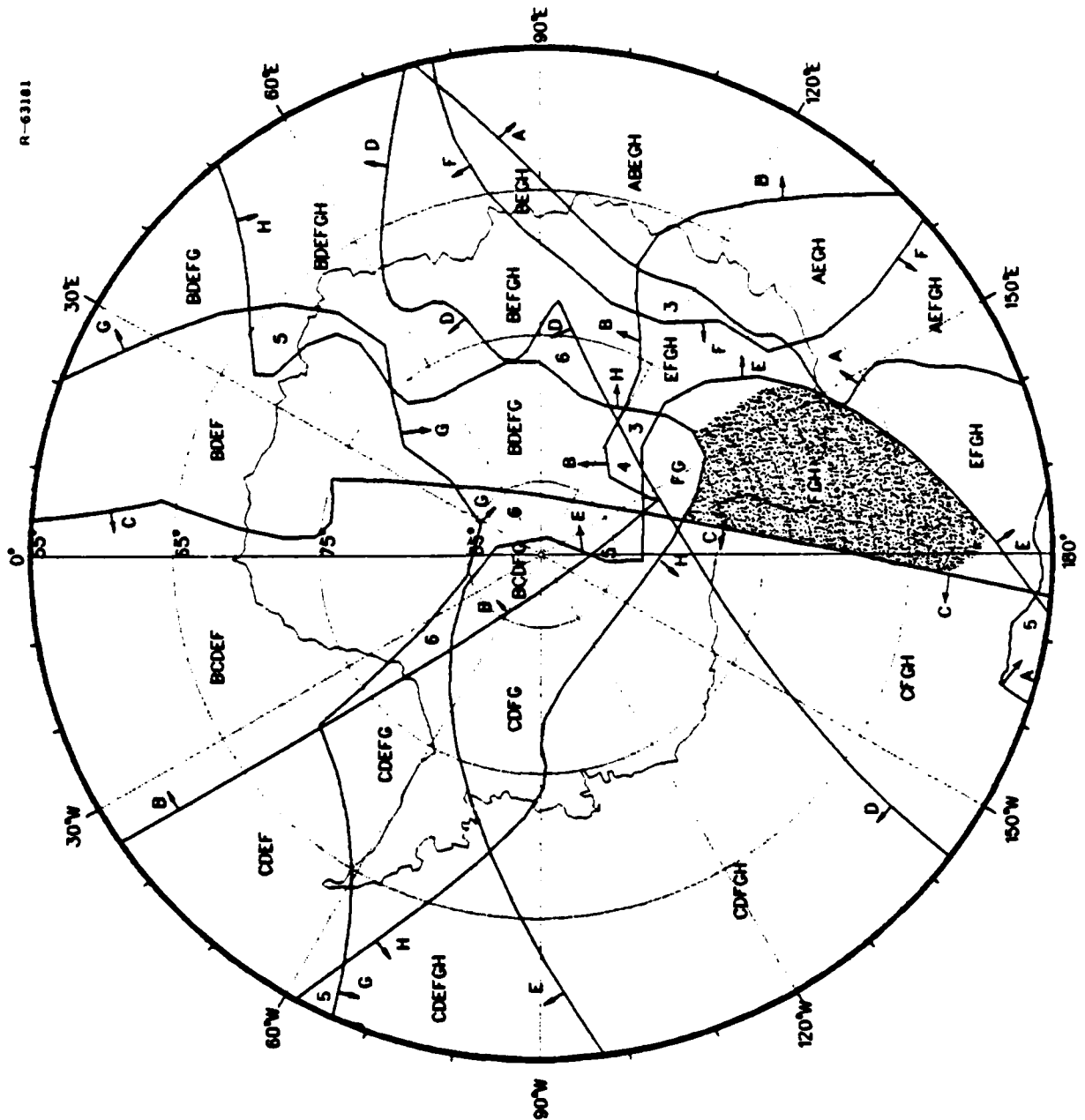


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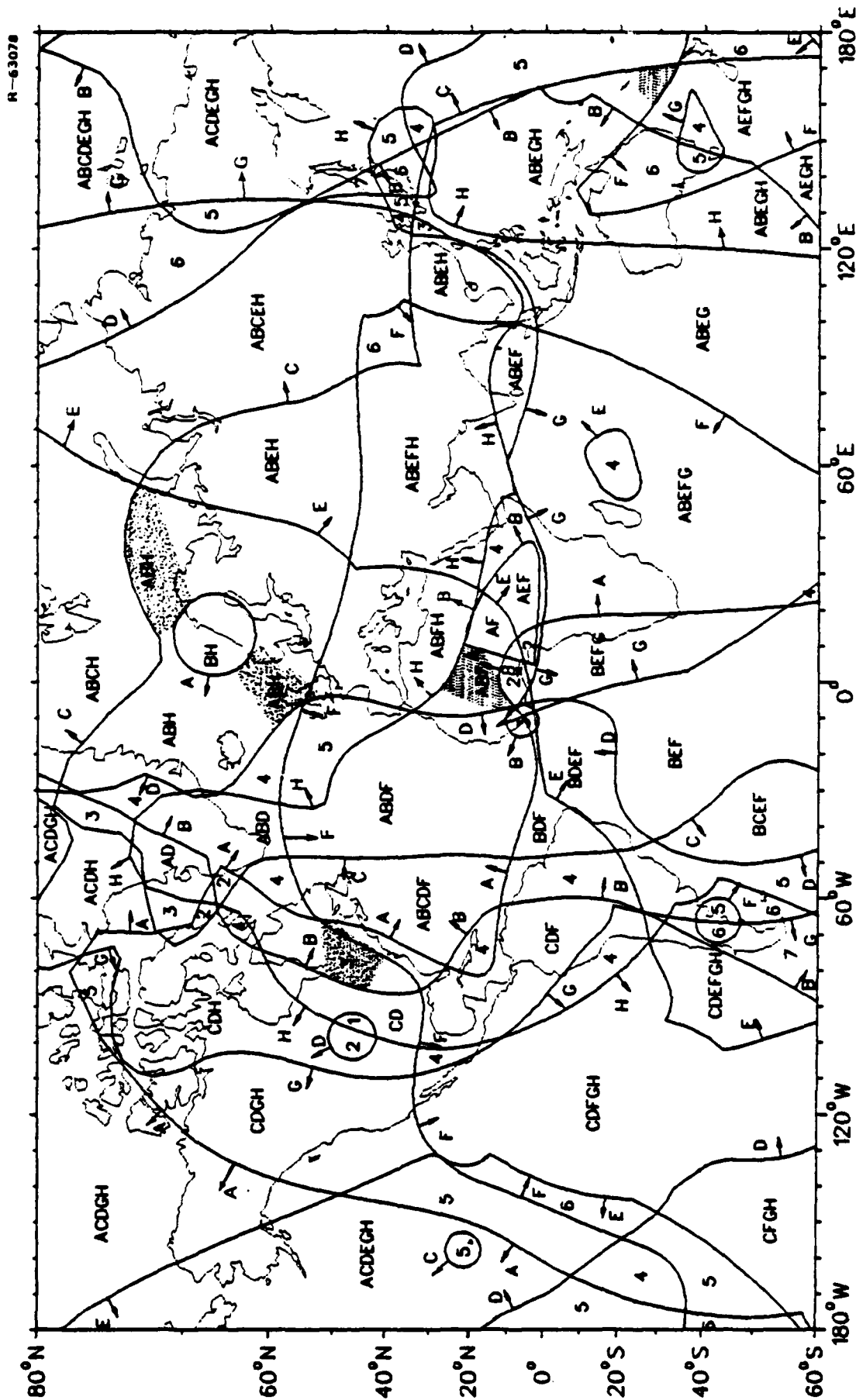
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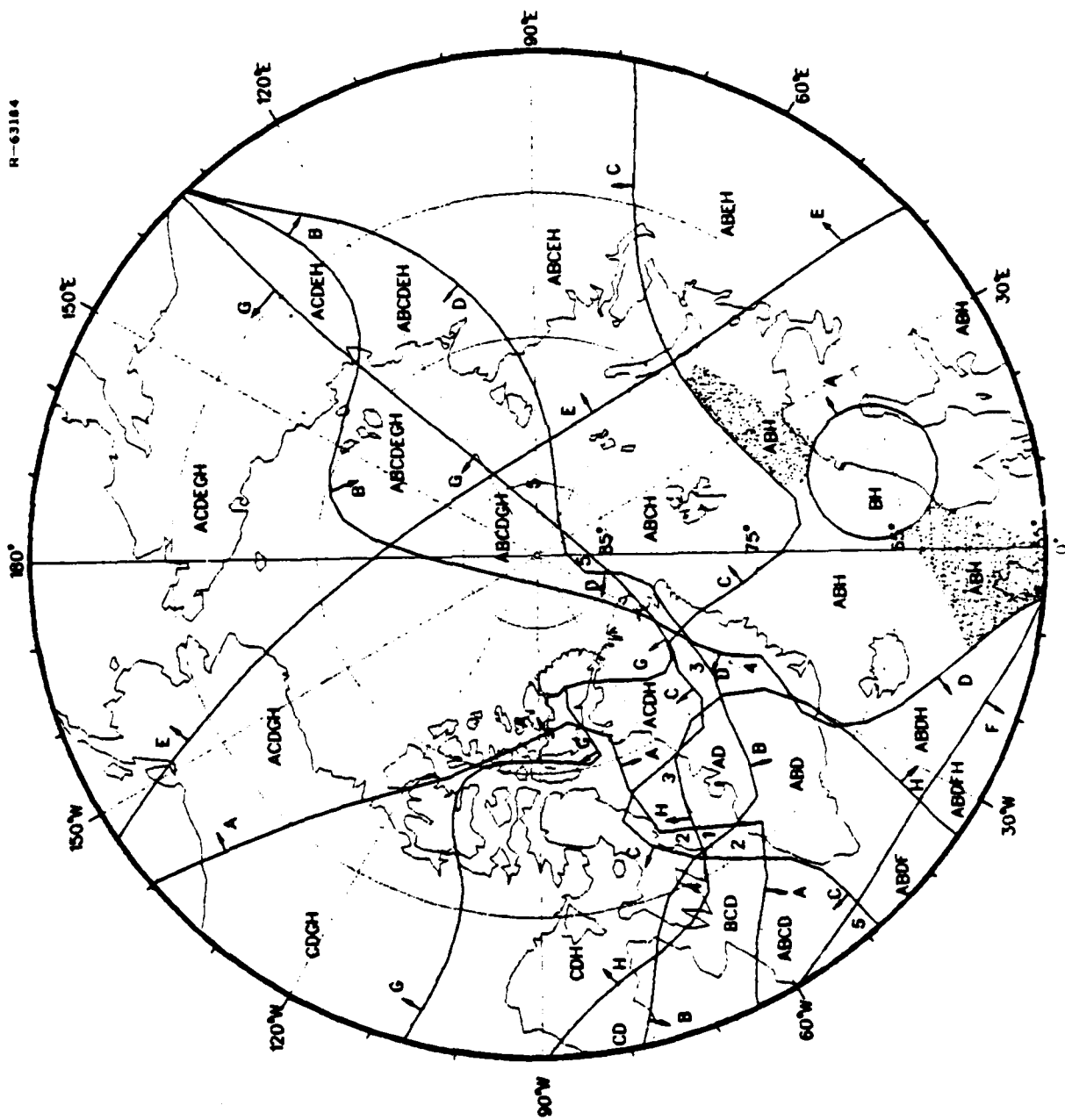
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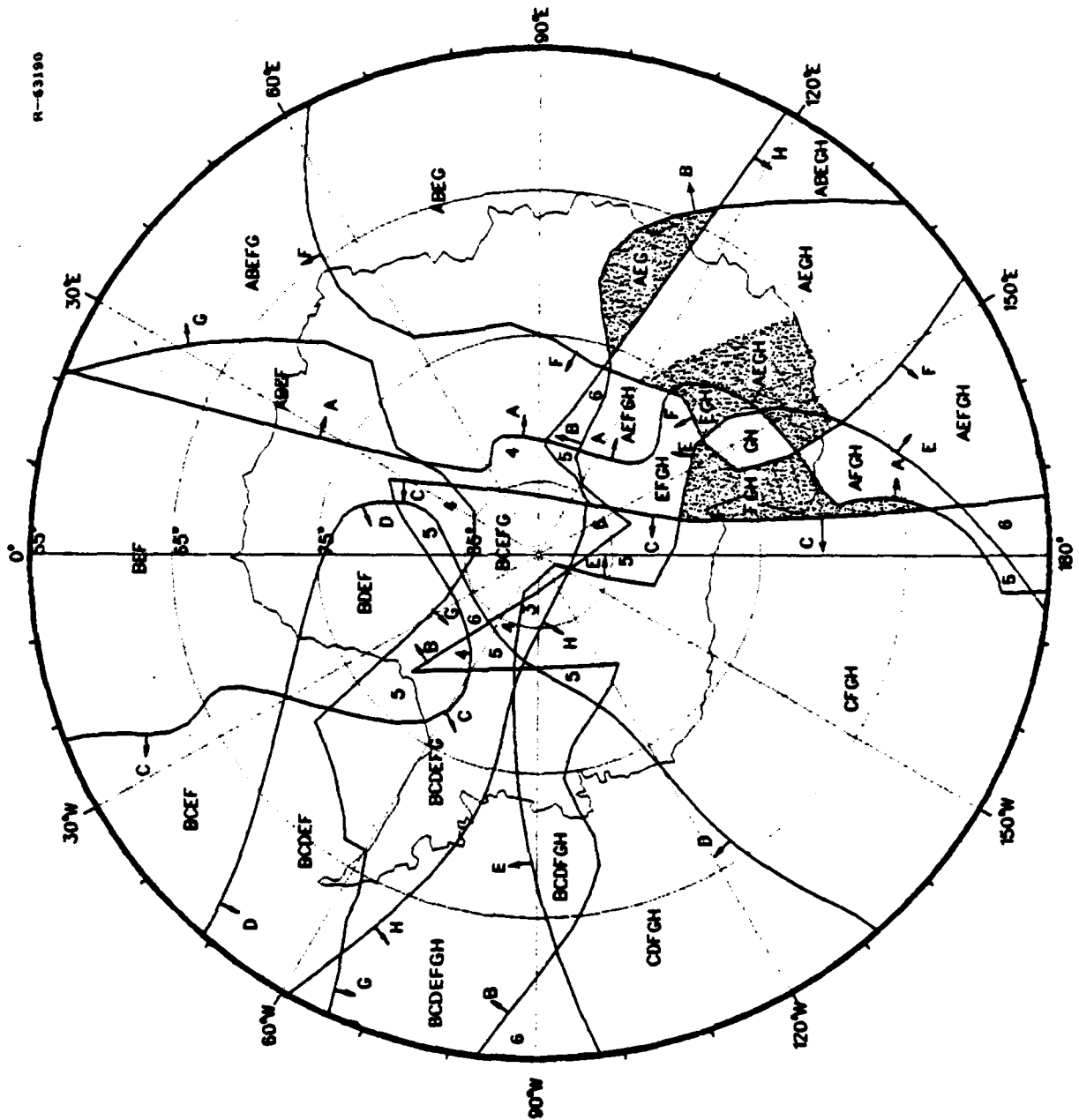


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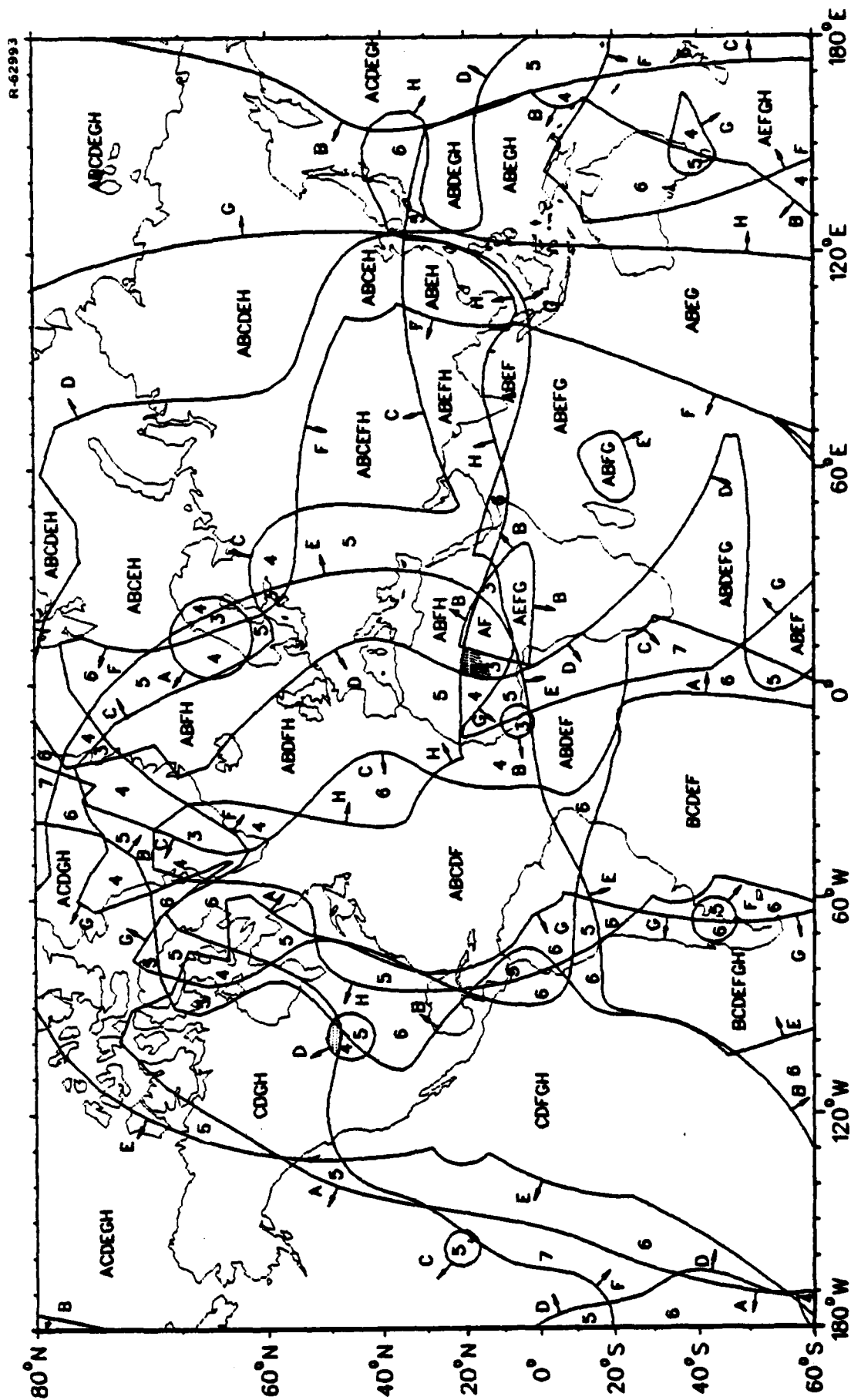
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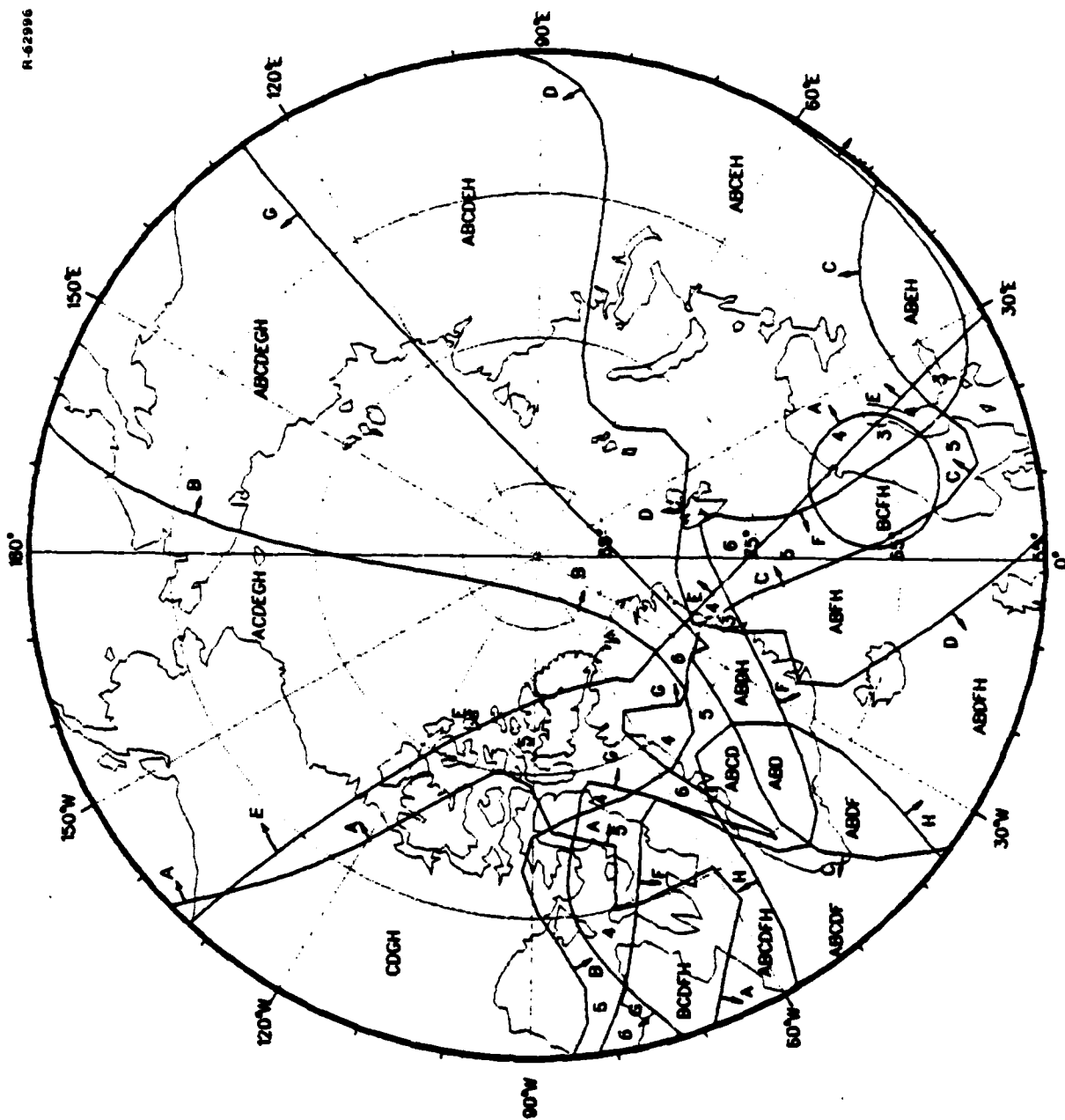
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-30 dB SNR



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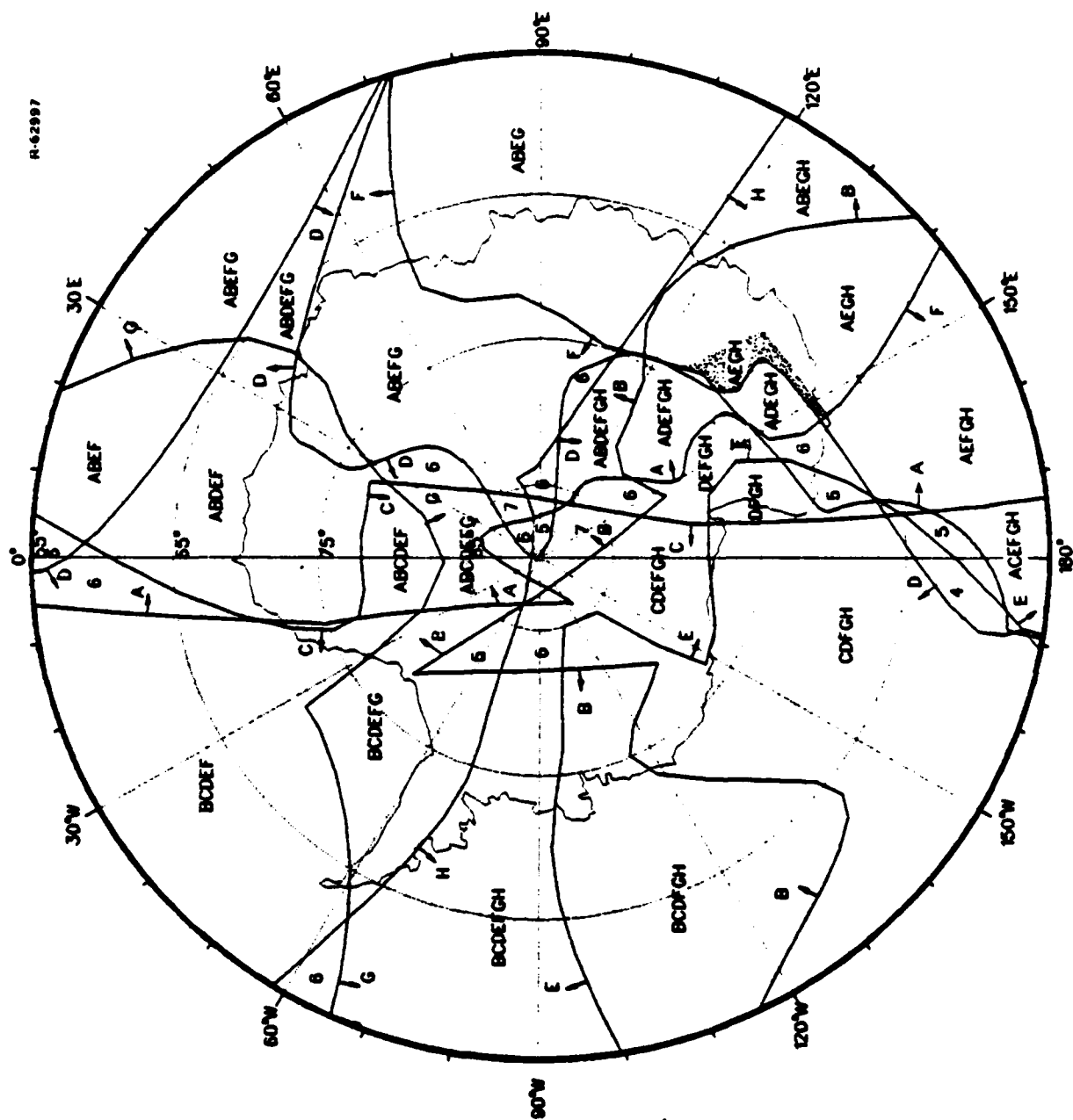
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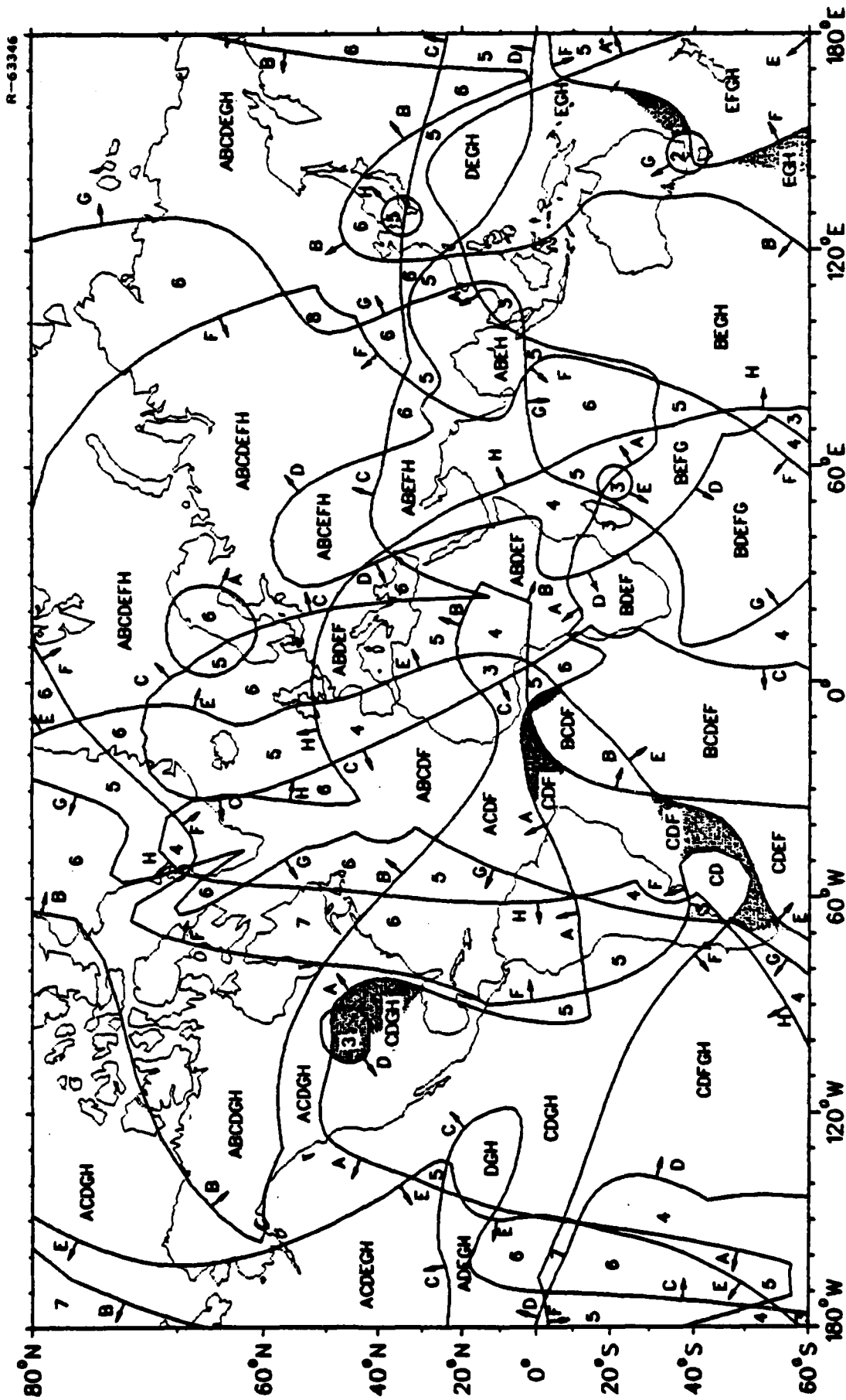
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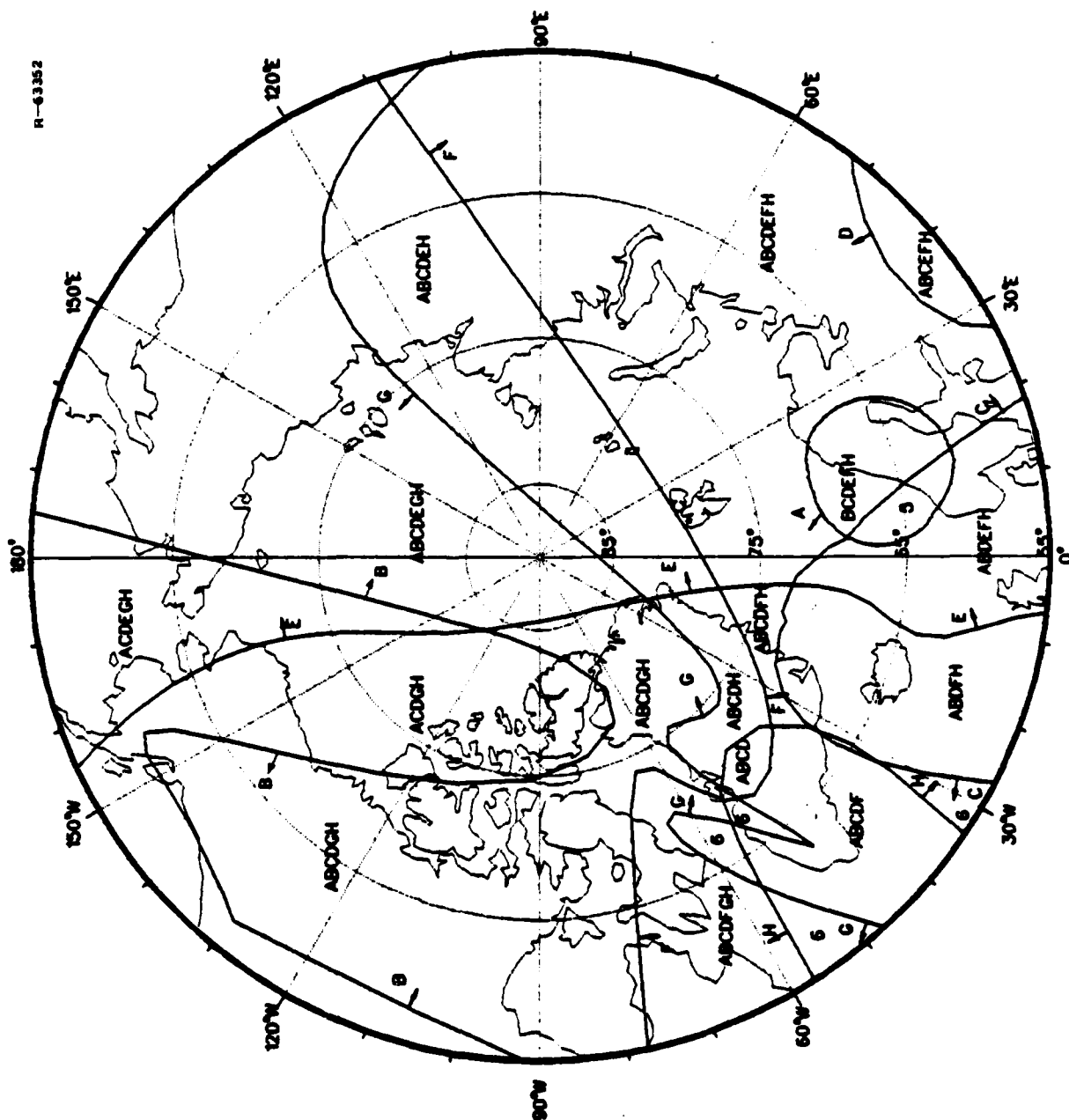
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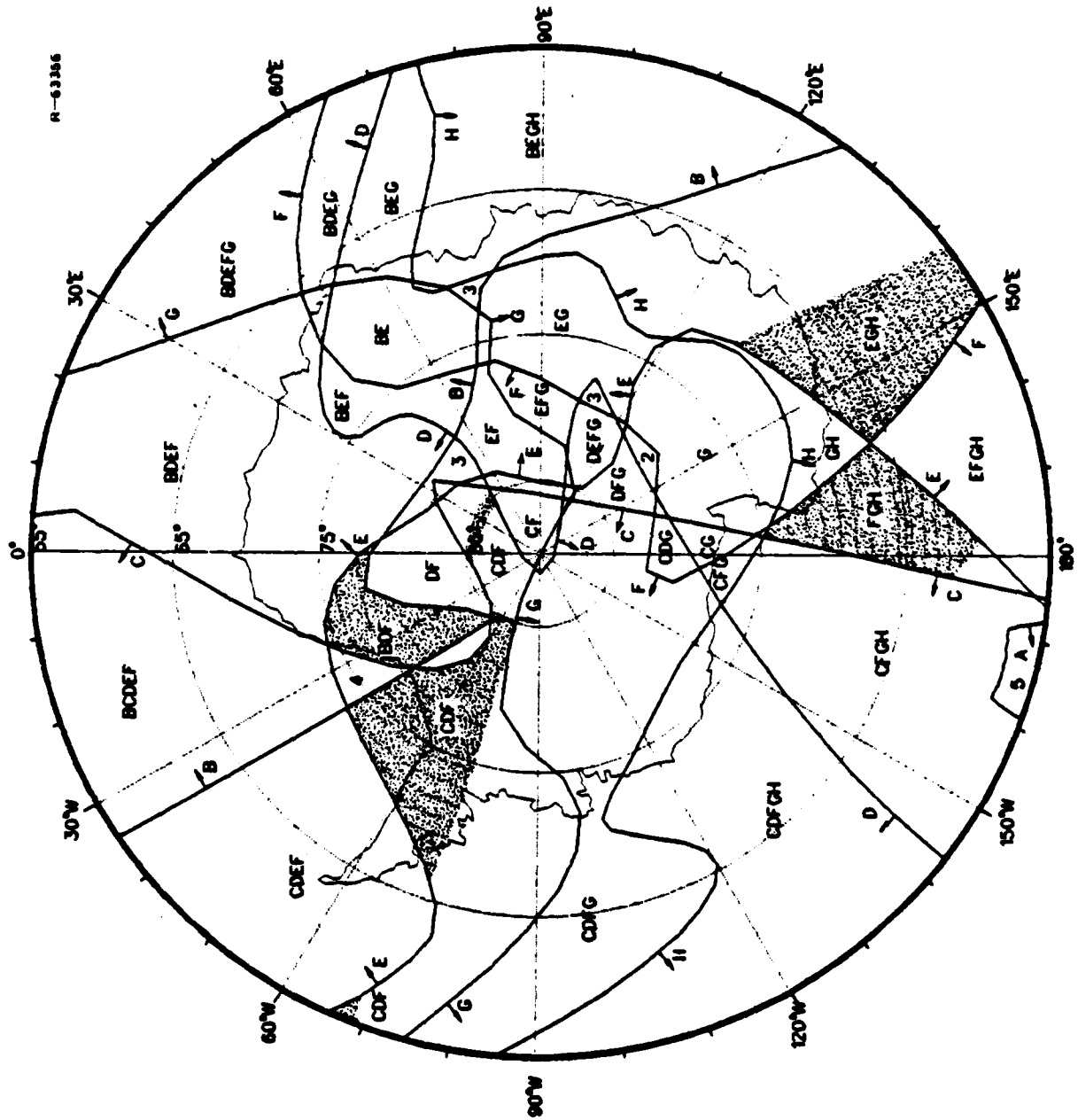
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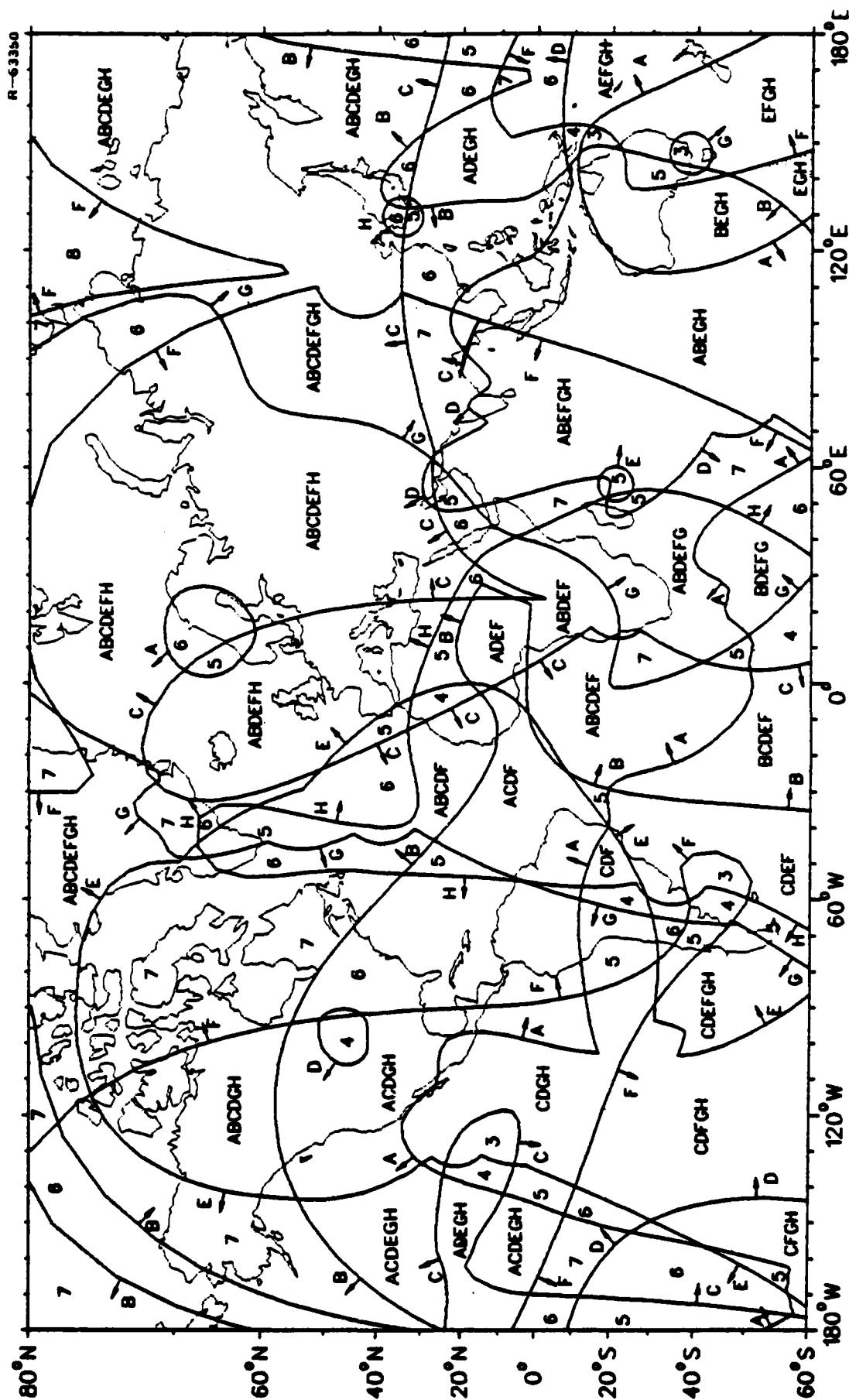
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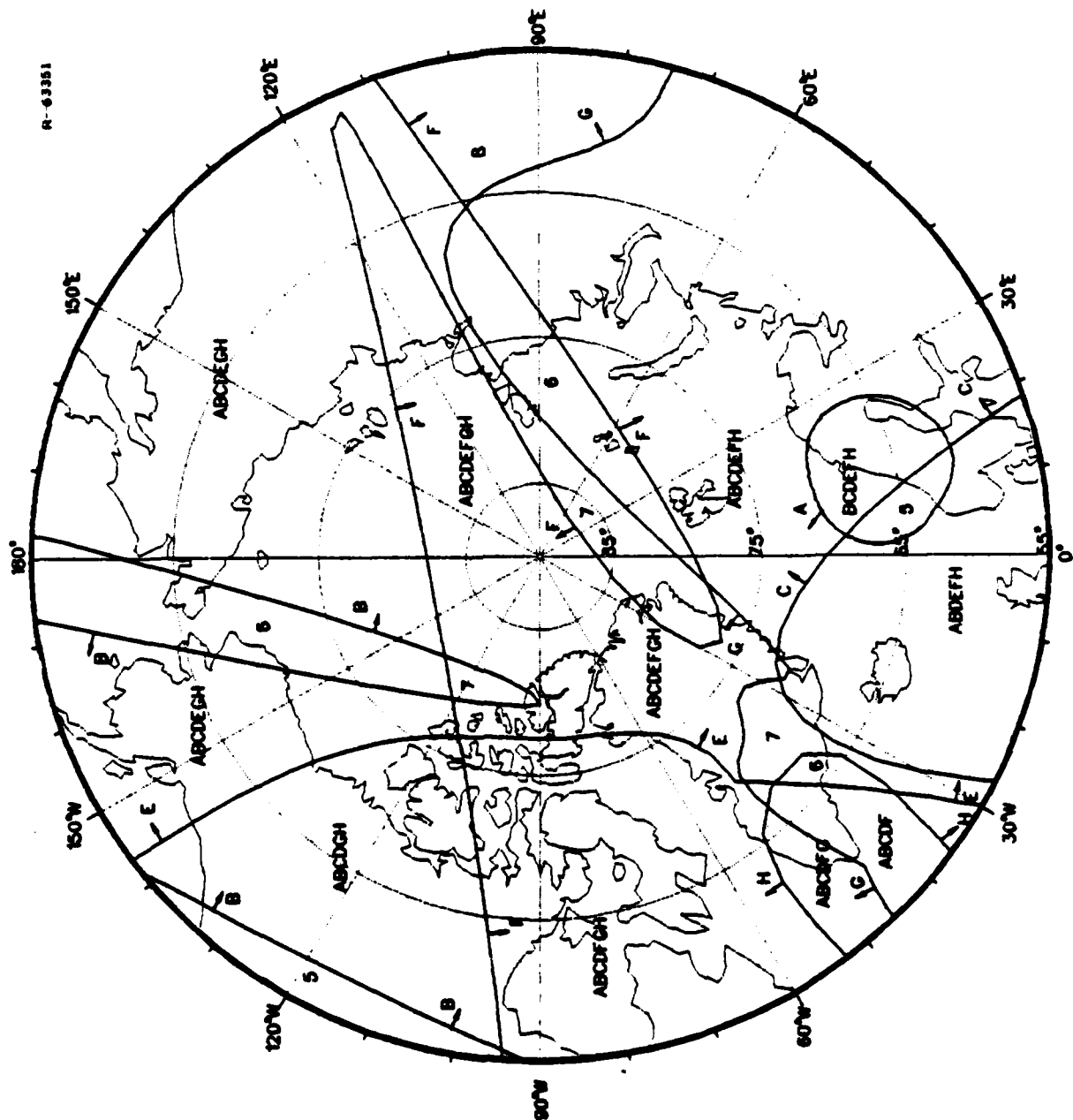


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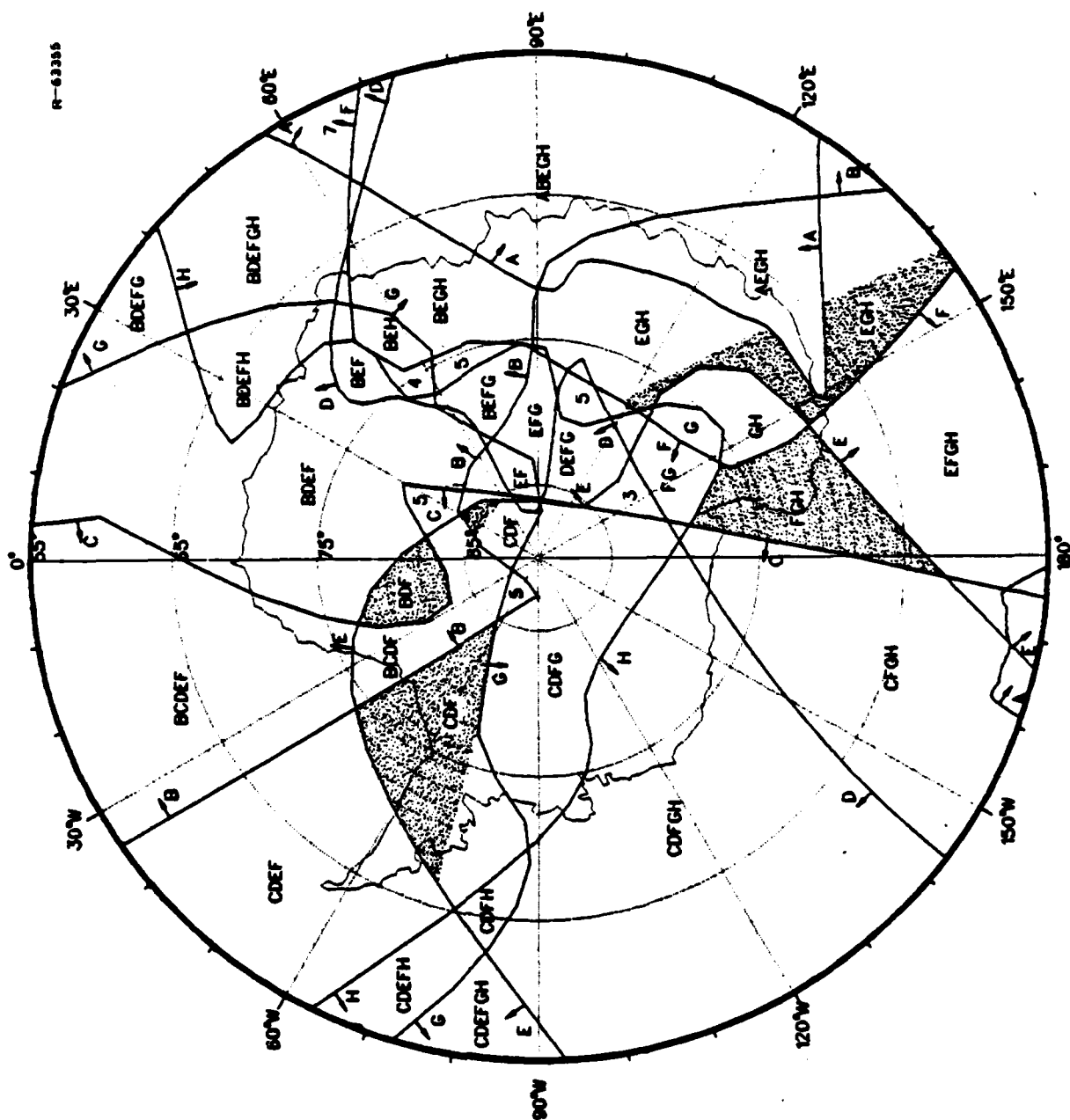
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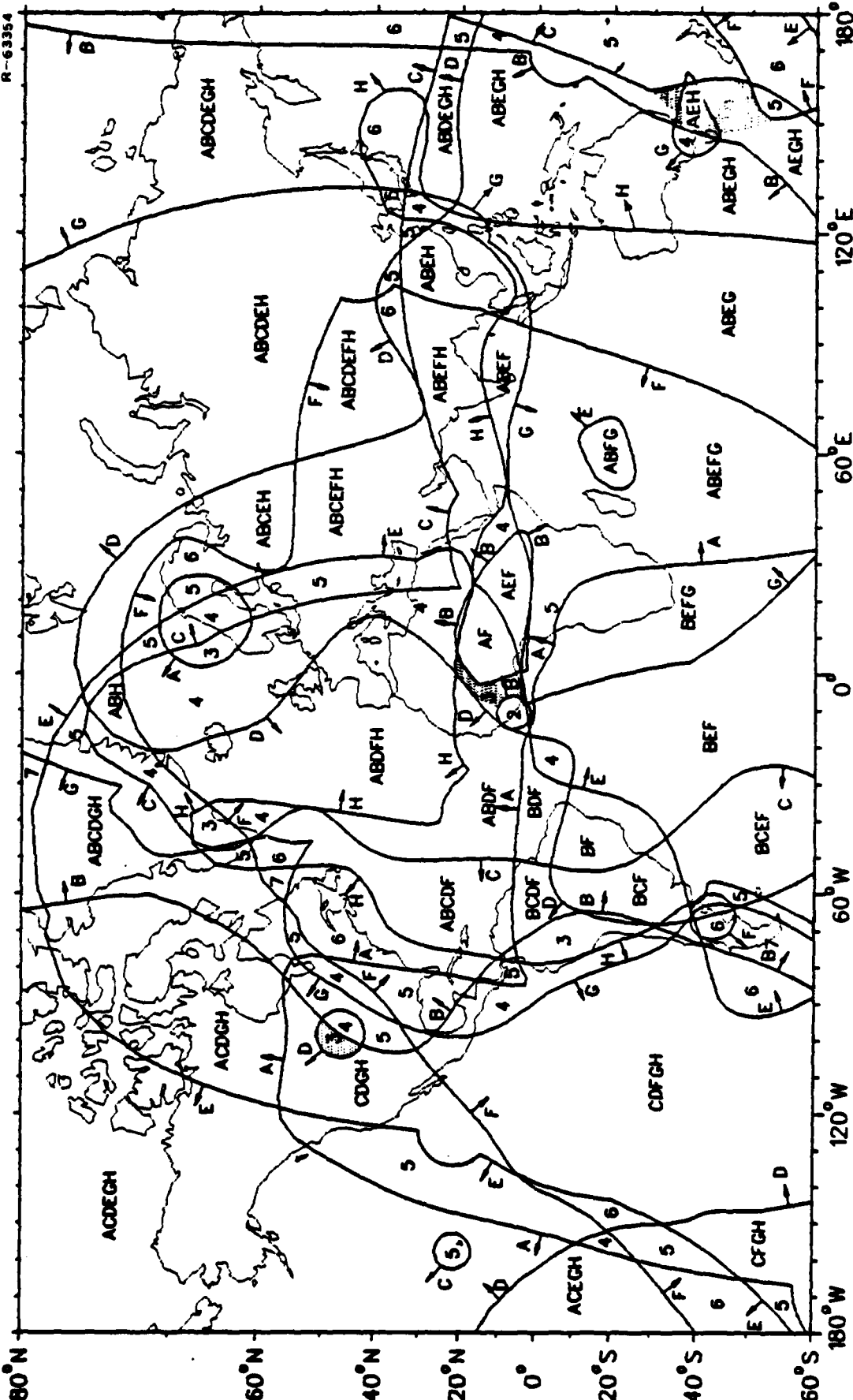
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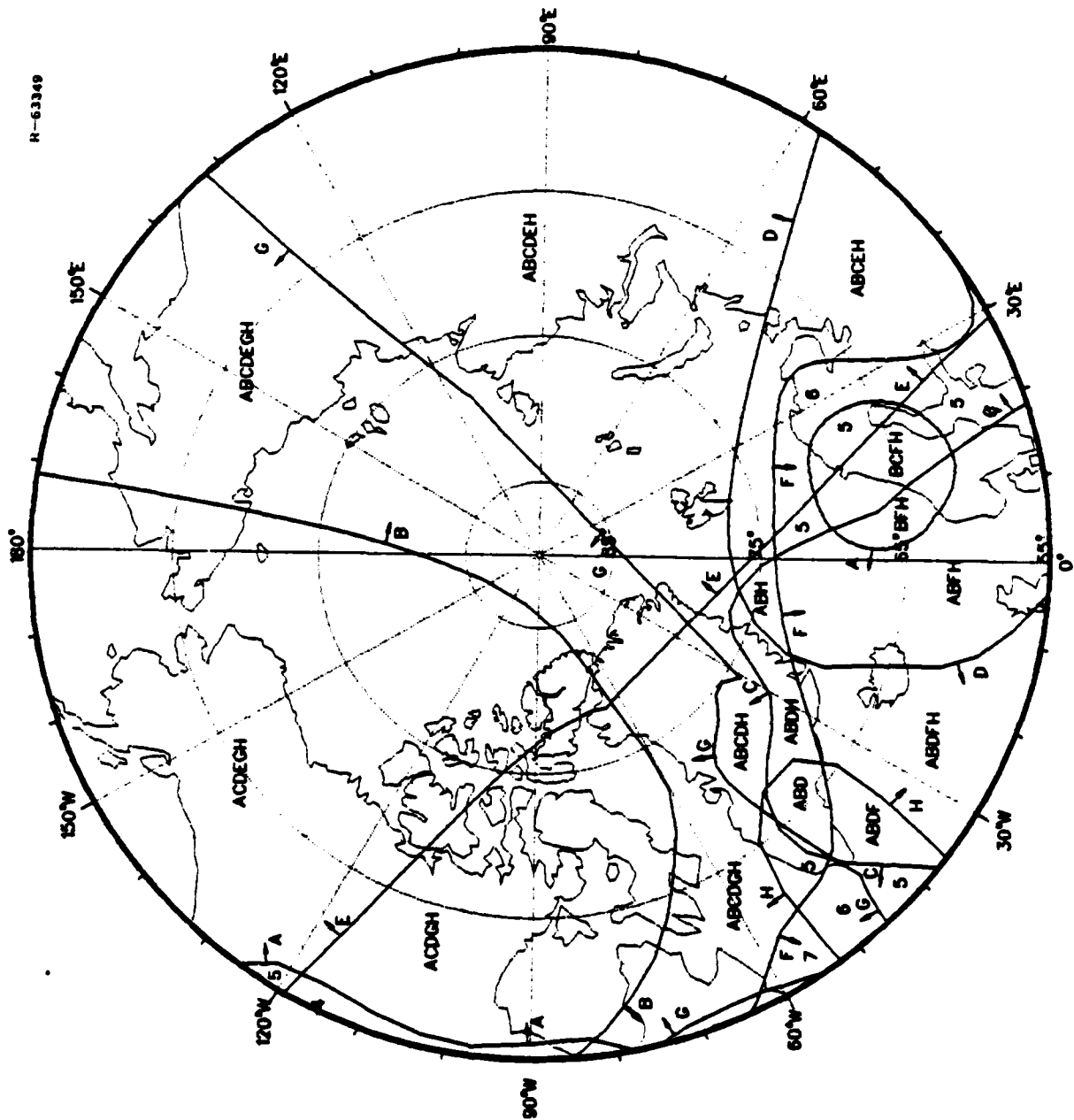
-20 dB SNR	NOVEMBER	1800 GMT
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0.02	0.02	0.02
0.03	0.03	0.03
0.04	0.04	0.04
0.05	0.05	0.05
0.06	0.06	0.06
0.07	0.07	0.07
0.08	0.08	0.08
0.09	0.09	0.09
0.10	0.10	0.10
0.11	0.11	0.11
0.12	0.12	0.12
0.13	0.13	0.13
0.14	0.14	0.14
0.15	0.15	0.15
0.16	0.16	0.16
0.17	0.17	0.17
0.18	0.18	0.18
0.19	0.19	0.19
0.20	0.20	0.20
0.21	0.21	0.21
0.22	0.22	0.22
0.23	0.23	0.23
0.24	0.24	0.24
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0.26	0.26	0.26
0.27	0.27	0.27
0.28	0.28	0.28
0.29	0.29	0.29
0.30	0.30	0.30
0.31	0.31	0.31
0.32	0.32	0.32
0.33	0.33	0.33
0.34	0.34	0.34
0.35	0.35	0.35
0.36	0.36	0.36
0.37	0.37	0.37
0.38	0.38	0.38
0.39	0.39	0.39
0.40	0.40	0.40
0.41	0.41	0.41
0.42	0.42	0.42
0.43	0.43	0.43
0.44	0.44	0.44
0.45	0.45	0.45
0.46	0.46	0.46
0.47	0.47	0.47
0.48	0.48	0.48
0.49	0.49	0.49
0.50	0.50	0.50
0.51	0.51	0.51
0.52	0.52	0.52
0.53	0.53	0.53
0.54	0.54	0.54
0.55	0.55	0.55
0.56	0.56	0.56
0.57	0.57	0.57
0.58	0.58	0.58
0.59	0.59	0.59
0.60	0.60	0.60
0.61	0.61	0.61
0.62	0.62	0.62
0.63	0.63	0.63
0.64	0.64	0.64
0.65	0.65	0.65
0.66	0.66	0.66
0.67	0.67	0.67
0.68	0.68	0.68
0.69	0.69	0.69
0.70	0.70	0.70
0.71	0.71	0.71
0.72	0.72	0.72
0.73	0.73	0.73
0.74	0.74	0.74
0.75	0.75	0.75
0.76	0.76	0.76
0.77	0.77	0.77
0.78	0.78	0.78
0.79	0.79	0.79
0.80	0.80	0.80
0.81	0.81	0.81
0.82	0.82	0.82
0.83	0.83	0.83
0.84	0.84	0.84
0.85	0.85	0.85
0.86	0.86	0.86
0.87	0.87	0.87
0.88	0.88	0.88
0.89	0.89	0.89
0.90	0.90	0.90
0.91	0.91	0.91
0.92	0.92	0.92
0.93	0.93	0.93
0.94	0.94	0.94
0.95	0.95	0.95
0.96	0.96	0.96
0.97	0.97	0.97
0.98	0.98	0.98
0.99	0.99	0.99
1.00	1.00	1.00

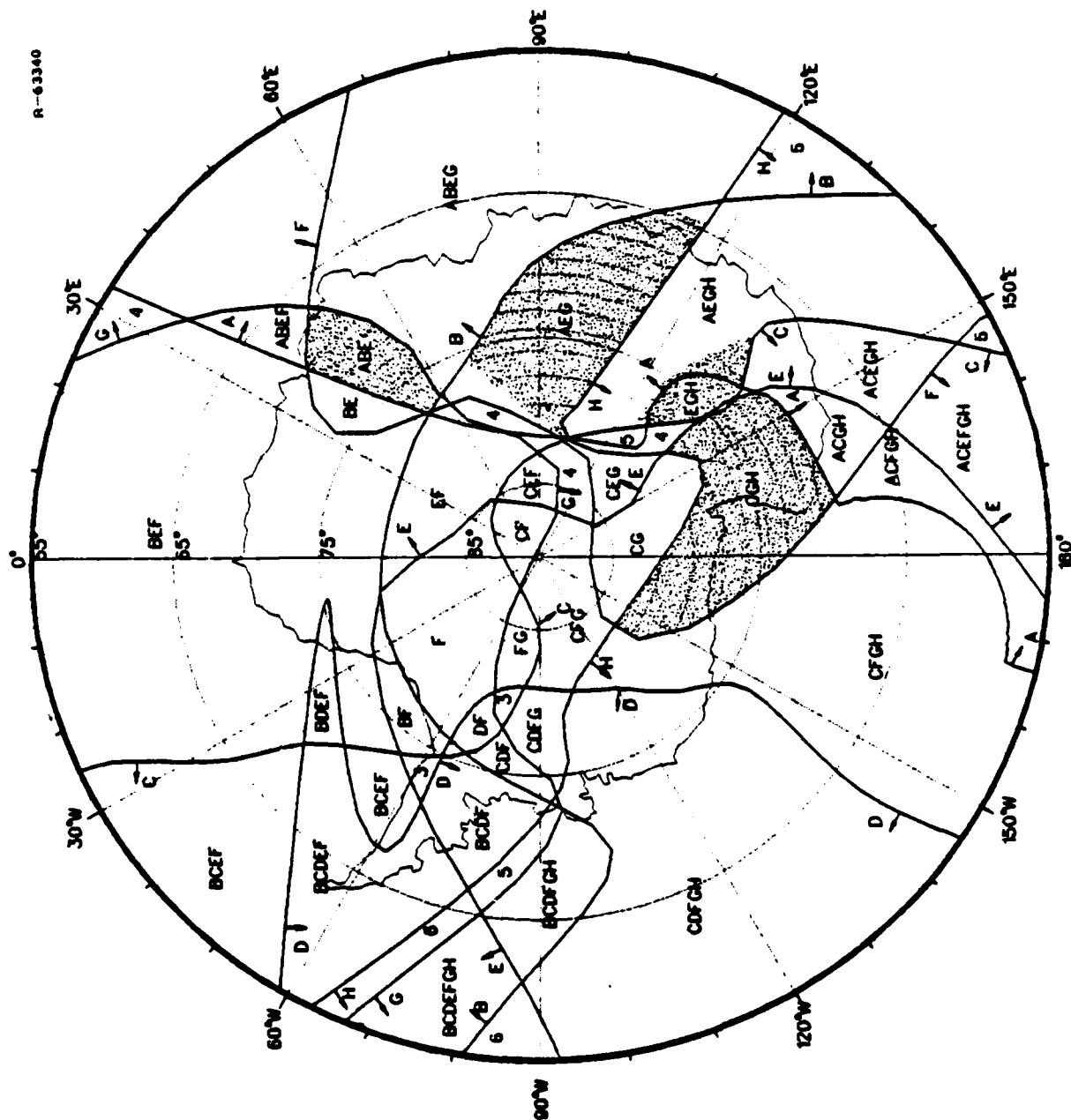
-20 dB SNR	NOVEMBER	1800 GMT
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AZ EQ DIST
(N POLE)
-20 dB SNR
NOVEMBER
1800 GMT

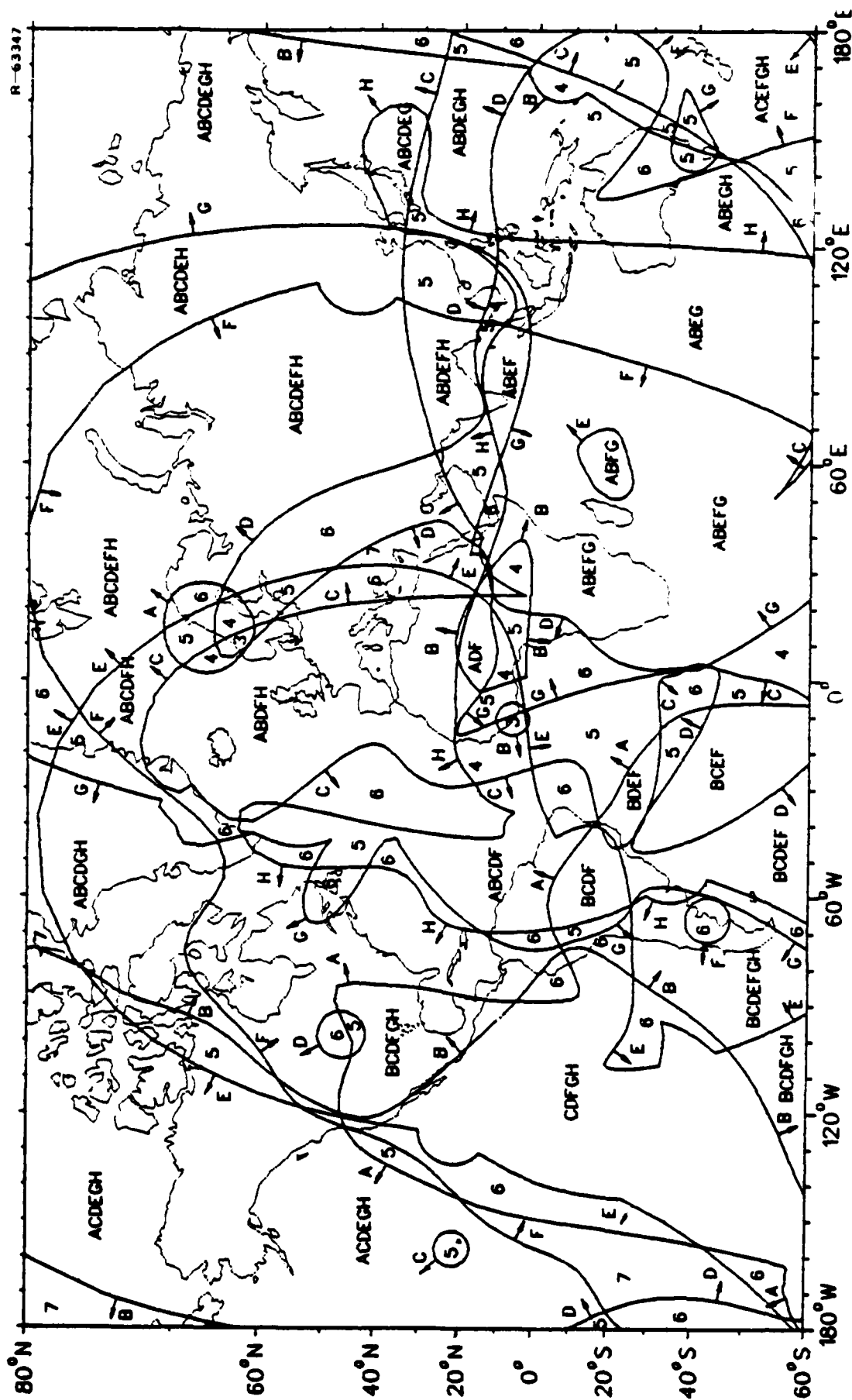


AZ EQ DIST
(S POLE)
-20 dB SNR
NOVEMBER
1800 GMT

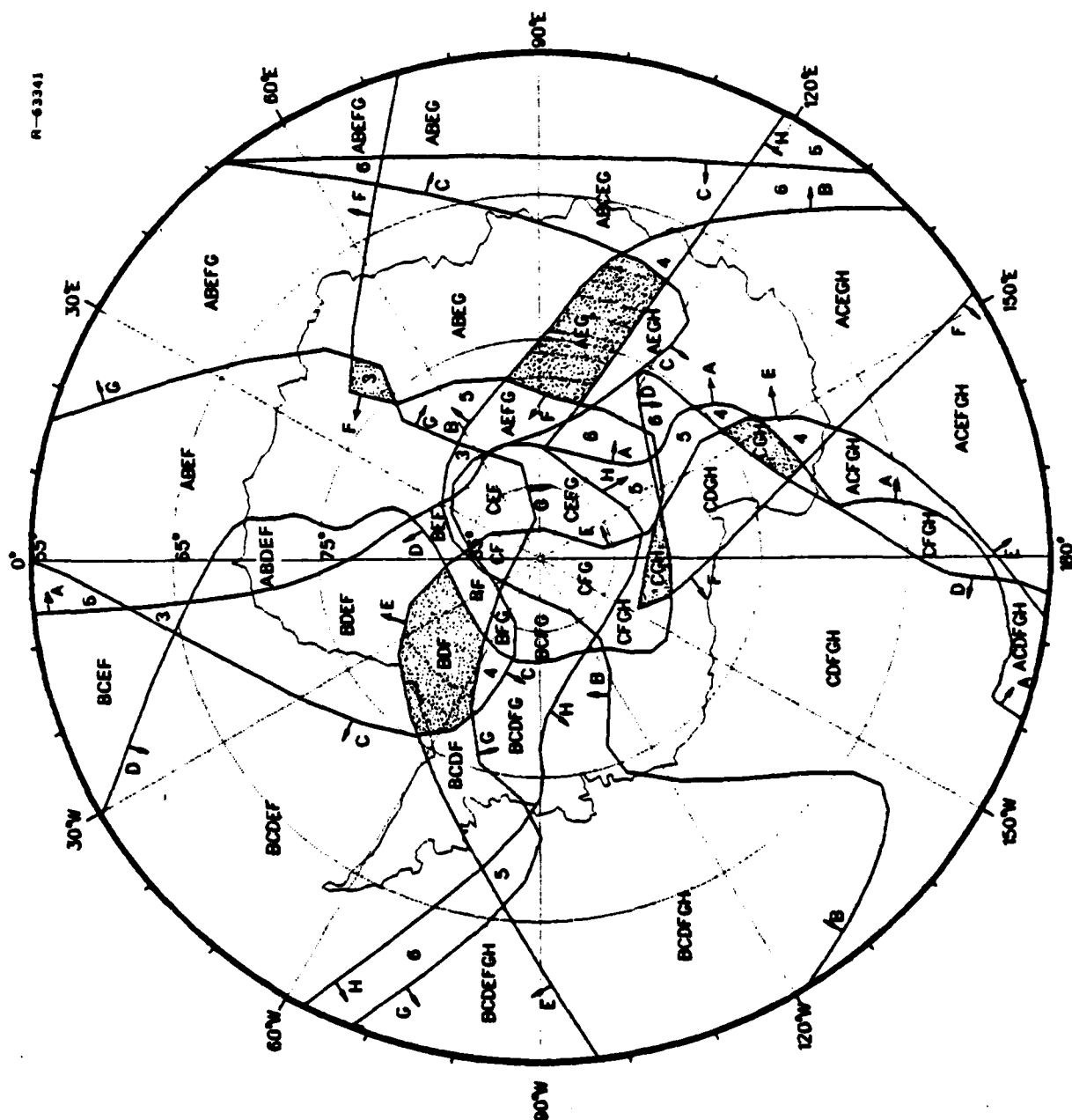


R-43340

-30 dB SNR



AZ EQ DIST
(S POLE)
-30 dB SNR
NOVEMBER
1800 GMT



R-63341